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DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEAR 1991

HEARINGS

BEFORE THE

COMMITTEE ON ARMED SERVICES UNITED STATES SENATE

ONE HUNDRED FIRST CONGRESS

SECOND SESSION

ON

S. 2884

AUTHORIZING APPROPRIATIONS FOR FISCAL YEAR 1991 FOR MILITARY ACTIVITIES OF THE DEPARTMENT OF DEFENSE, FOR MILITARY CONSTRUCTION, AND FOR DEFENSE ACTIVITIES OF THE DEPARTMENT OF ENERGY, TO PRESCRIBE PERSONNEL STRENGTHS FOR SUCH FISCAL YEAR FOR THE ARMED FORCES AND FOR OTHER PURPOSES

PART 7

STRATEGIC FORCES AND NUCLEAR DETERRENCE

APRIL 4; MAY 3, 9, 23, 24; JUNE 6, 20, 1990

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DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEAR 1991

THURSDAY, APRIL 5, 1990

U.S. SENATE,
SUBCOMMITTEE ON STRATEGIC FORCES
AND NUCLEAR DETERRENCE,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

CHEMICAL DETERRENT PROGRAMS

The subcommittee met, pursuant to notice, at 2:04 p.m., in room SR-222, Russell Senate Office Building, Senator J. James Exon, (chairman of the subcommittee) presiding.

Committee members present: Senators Exon and Thurmond.

Committee staff members present: Lucia M. Chavez, security control officer.

Professional staff member present: Robert G. Bell.

Minority staff members present: Brian D. Dailey, George W. Lauffer, and John E. Mansfield, professional staff members.

Staff assistant present: Mickie Jan Wise.

Committee members' assistants present: Andrew W. Johnson, assistant to Senator Exon; Milton D. Beach, assistant to Senator Glenn; Leon S. Fuerth, assistant to Senator Gore; Patrick F. McCartan, assistant to Senator Wilson; Robert M. Soofer, assistant to Senator Gorton; and Eric H. Thoemmes, assistant to Senator Coats.

OPENING STATEMENT OF SENATOR J. JAMES EXON, CHAIRMAN

Senator EXON. The committee will please come to order. The Subcommittee on Strategic Forces and Nuclear Deterrence meets this afternoon to receive testimony on the Defense Department's Chemical Deterrence Program for fiscal year 1991.

Our hearing today occurs against a backdrop of conflicting trends in the area of chemical warfare. On the one hand there have been a number of positive and encouraging developments, both in arms control and with respect to the extraordinary events in Eastern Europe and the Soviet Union. Progress has been reported in the Geneva negotiations on an international convention banning chemical weapons production and stockpiling worldwide. Participants in these negotiations speak optimistically of completing the draft treaty within a year or two.

In addition, the United States and Soviet Union have decided to try to provide impetus to the Geneva talks by negotiating a bilateral U.S.-Soviet reduction agreement that would require the destruction of the bulk of their chemical weapons stock to equal low levels.

In February, Secretary Baker and Foreign Minister Shevardnadze agreed to try to have this bilateral agreement ready for signature at the June Summit.

Even more profound, though, are the implications of the greatly diminished threat of a Warsaw Pact attack against NATO. As the Warsaw Pact falls apart and the threat that the Soviets might have to go it alone, the attack fears we have always had recedes significantly. Our requirement, therefore, for conventional forces in Eastern Europe are reduced accordingly, including reductions in our requirement for NATO-oriented inventories of chemical retaliatory munitions and chemical protective equipment.

At the same time, however, there are worrisome developments elsewhere in the world, in particular, in the Middle East. The recent outburst by the president of Iraq has underscored that the threat of chemical weapons use is increasingly becoming magnified by its spread into the Third World, and also of the spread in that part of the world of ballistic missile technology and other means of delivering such weapons of mass destruction at long range.

At a committee hearing in January, CIA Director Webster testified that by the year 2000, at least six Third World nations will have missiles with ranges up to 5,500 kilometers.

This afternoon we will hear how the Defense Department proposes to adjust its chemical programs to take account of these competing developments. Our witnesses are Dr. Bill Richardson, Deputy Assistant to the Secretary of Defense for Chemical Matters, and Mrs. Susan Livingstone, Assistant Secretary of the Army for Installations, Logistics and the Environment.

Dr. Richardson will address the chemical, retaliatory and defensive equipment programs and Mrs. Livingstone will discuss technical demilitarization programs. It is my intention to conduct the entire hearing in the open, and I think that is the way we will proceed. However, if there are any questions that cannot be answered in an unclassified or in an open session, or are classified, then we will by necessity have to go into a closed session.

I understand that the full committee has been scheduled to meet here in this room at 4 p.m., so we will need to keep that time frame in mind as we proceed with this hearing. With that in mind, I would encourage both of the witnesses, if they could, to summarize their testimony, which will be accepted in full as a part of the record without objection at this time. And then when I call on the witnesses, if they could summarize, then maybe we can cut down the amount of time that we will tie you up this afternoon and be in a position to adequately meet our deadline of 4 p.m.

With that, before we hear from the witnesses, I am very pleased to turn for any opening remark from my friend and colleague, Senator Thurmond.

Senator **Thurmond**. Thank you very much, Mr. Chairman.

Mr. Chairman, I join you in welcoming the witnesses and look forward to their testimony. The testimony of the witnesses is important, given the problems that we have had with the chemical modernization program.

Last year, the Congress restricted the obligation of funds for the 155 millimeter binary artillery shell, because of backlog and production problems associated with this chemical program. GAO reports required under the legislation indicate that while the backlog of 155 millimeter binary rounds is being eliminated, it apparently is not sufficient to comply with the congressional restriction of the obligation of funds. I hope the witnesses can provide the committee with a full assessment of the situation.

This year is also important for the Bigeye binary chemical bomb. The Bigeye is an important capability necessary to support the requirements of our chemical deterrent force, but it too has been plagued with development and production problems. After a 2-year slowdown period in the Bigeye program, we have a fiscal year 1991 funding request of nearly $58 million for the start of production.

Again, the GAO has indicated that all of the testing and certification requirements stipulated in the congressional guidance of September 29, 1988 have not been achieved at this time. Consequently, I hope the witnesses can also provide us with a projection of when these requirements will be fulfilled.

There are a number of other issues that I hope we can address today, such as Chemical Demilitarization, the European chemical retrograde, Chemical Treaty monitoring and Chemical Defense programs. All of the above programs are important and contribute in some way to our ability to negotiate a verifiable Chemical Weapons Treaty and to maintain a credible chemical deterrent.

There have been numerous problems associated with our Chemical Weapon program. I hope these can be resolved for it is important that we have a modern chemical deterrent capability, given the proliferation of chemical weapons to Third World countries and the enormous existing Chemical and Biological Weapons programs of the Soviet Union. Until a global, verifiable Chemical Treaty is negotiated, we must continue to maintain a modern and safe chemical deterrent.

Thank you, Mr. Chairman.

Senator Exon. Senator Thurmond, thank you very much. We will now go to our witnesses. Welcome to both of you.

Dr. Richardson, I believe we will start with you.

STATEMENT OF DR. B. RICHARDSON, DEPUTY ASSISTANT TO THE SECRETARY OF DEFENSE (CHEMICAL MATTERS), ACCOMPANIED BY LARRY D. PFITZENMAIER, CAPTAIN, USN, PROGRAM MANAGER, BIGEYE BOMB; JOHN O.B. SEWALL, MAJOR GENERAL, USA, JOINT CHIEFS OF STAFF (STOCKPILE ADEQUACY, BINARY); WILLIAM C. DEE, U.S. ARMY, PROGRAM MANAGER, BINARY; LISA BRONSON, OFFICE OF THE SECRETARY OF DEFENSE (BILATERAL AGREEMENTS); RICHARD E. HAWLEY, MAJOR GENERAL, USAF, (SURVIVABLE COLLECTIVE PROTECTION SYSTEMS); AND LOU DEL ROSSO, MAJOR GENERAL, HEADQUARTERS, DEPARTMENT OF THE ARMY

Dr. Richardson. Thank you, Mr. Chairman, to you and Senator Thurmond. It is good to see both of you again. We appreciate the interest in the program.

As you have asked, I will have my testimony for the record and simply give you some brief opening remarks.

As the chairman has noted, there have been major changes in the world. And those are mind boggling in their rate of occurrence. But even as this week's papers illustrate, the point is also valid that we still have reason to be concerned about the critical areas of chemical warfare and chemical warfare defense. We have a need to give our personnel protection against the possibility that they will be hit with these horrendous agents.

Responses to the President's initiatives in chemical arms control give hope that the chemical threat will be reduced and eventually eliminated. However, we still, as the chairman has noted, have more countries than ever before with a chemical capability. We have more than 10 countries with a biological warfare capability.

With the advancing technology and the proliferation of delivery systems, the threat is getting more sophisticated, more extensive and more hazardous to our personnel.

The Department of Defense continues to have the combined approach that we have been pursuing for some years now: defensive equipment to protect our forces, deterrents to discourage the use of chemical weapons against our forces and the negotiation of an effective ban to eliminate such weapons.

I feel we have made progress in the past year. Some of the noteworthy items I see are typified by these examples. In the defensive area, just a couple of weeks ago, we let a contract for the NBC reconnaissance system. It is an armored wheeled vehicle, the first such system we have had. It takes us from the era of having detector paper on a stick to having a modern device and system to allow rapid reconnaissance.

In deterrence, I think we have made good progress in the areas that Senator Thurmond mentioned. The ability to produce components for the M687 155mm binary artillery shell has greatly improved in the past year. And I have confidence that there is going to be a successful effort during the course of the year. I have recently visited the manufacturing line for the Bigeye bomb. It is an impressive facility, with modern equipment, and it is producing bombs to be filled with simulant for testing at this time.

In the new area of research and development in support of chemical treaties and conventions, I think the particularly notable thing there is the interagency cooperation that has been developing in recent months. We have worked hard to deal with other agencies to work that complex area, and we see many of them coming in with us to sort through the possibilities and technologies for effective treaties.

Another item in the defensive area that has been of interest to members of this committee is that we now have a comprehensive chemical agent safety regulation ready for publication. We have another regulation on biological safety in final staffing and we hope to have that in publication in the latter part of this year.

Every site that has chemical or biological warfare defense activities ongoing has been visited by Army safety teams this year for review. It has also been visited by OSHA. And so far as we have heard on the OSHA review, and I know on our own review, everything has been found to be in an excellent, satisfactory manner.

For the fiscal year 1991, our division of funding is much the same general approach that we have had in the past. Most of the effort is on defensive material, 45 percent. Thirty-seven percent of the total funding is for destruction of existing unitary stockpiles; 15 percent is for retaliatory or deterrent capability. And newly started this year, about 2 percent is for the area of treaty research and development.

With those funds we will continue the update of defensive capability, expand that capability. We will continue the production of the 155 binary projectile. We will do the initial purchases required for the initial production of the Bigeye bomb and continue research and development on the multiple launch rocket system. We will continue and slightly increase the research and development that we started in fiscal year 1990 on treaty R&D.

The Army is, of course, executive agent for the chemical demilitarization program, and I am honored to share this forum with Mrs. Susan Livingstone, the Assistant Secretary of the Army for Installations, Logistics and Environment. And she will address, as you mentioned, the demilitarization area.

I also have several authorities with me, in case we get into detail that is beyond my ability or memory. I would particularly mention with me is Maj. Gen. John Sewall of JCS; Maj. Gen. Dick Hawley of the Air Staff; on my left, behind me, is Maj. Gen. Lou Del Rosso of Headquarters, Department of the Army; and again on my right, Capt. Larry Pfitzenmaier, the program manager for the Bigeye bomb.

Sir, at this time, I will turn the microphone to Susan Livingstone, for her comments on demilitarization.

[The prepared statement of Dr. Richardson follows:]

STATEMENT BY

DR. B. RICHARDSON

DEPUTY ASSISTANT TO THE SECRETARY OF DEFENSE

(CHEMICAL MATTERS)

INTRODUCTION

WE WELCOME THE OPPORTUNITY TO DISCUSS THE DEPARTMENT OF DEFENSE CHEMICAL WARFARE, CHEMICAL AND BIOLOGICAL DEFENSE, CHEMICAL WEAPONS TREATY VERIFICATION RESEARCH AND DEVELOPMENT, AND CHEMICAL DEMILITARIZATION AND RETROGRADE PROGRAMS.

GENUINE PROGRESS IS BEING MADE IN REALIZING OUR GOAL OF "ELIMINATING THE TERRIBLE SCOURGE OF CHEMICAL WEAPONS FROM THE FACE OF THE EARTH." THE BILATERAL NEGOTIATIONS WITH THE SOVIET UNION AND THE MULTILATERAL DISCUSSIONS AT THE CONFERENCE ON DISARMAMENT IN GENEVA PROVIDE A SOLID BASE FOR HOPE. THESE EVENTS ARE DIRECTLY ATTRIBUTABLE TO OUR CURRENT POLICY OF DETERRENCE, WHICH PRECLUDES ANY PERCEPTION BY POTENTIAL ADVERSARIES THAT THEY COULD GAIN ADVANTAGE BY INITIATING CHEMICAL OR BIOLOGICAL WARFARE. SHOULD THAT DETERRENCE FAIL, WE MUST HAVE THE CAPABILITY TO SURVIVE CHEMICAL ATTACKS, CONTINUE OPERATING EFFECTIVELY AND, MOST IMPORTANTLY, RETALIATE IN A PROPORTIONATE MANNER TO SWIFTLY AND SURELY STOP CHEMICAL WARFARE. DETERRENCE IS BASED ON BOTH AN EFFECTIVE CHEMICAL RETALIATORY CAPABILITY TO CONVINCE AN ADVERSARY THAT HIS FORCES WILL SUFFER UNACCEPTABLE CONSEQUENCES IF HE INITIATES CHEMICAL WARFARE, AND A STRONG DEFENSIVE CAPABILITY BECAUSE OF OUR PARAMOUNT PRINCIPLE OF NO FIRST USE. LACKING EITHER OF THESE CAPABILITIES, IN THE ABSENCE OF A FULLY IMPLEMENTED ARMS CONTROL REGIME, THE UNITED STATES WOULD HAVE NO CREDIBLE DETERRENT.

ALTHOUGH, WE HAVE MADE GOOD PROGRESS TOWARD A SAFE AND CREDIBLE DETERRENT, WE ARE NOT THERE YET. WE MUST STAY THE COURSE, AND WE SOLICIT YOUR CONTINUED SUPPORT IN DOING SO.

THE PROBLEM

PROGRESS IN ARMS CONTROL IS HEARTENING, BUT IT HAS NOT CHANGED THE FACT THAT MORE NATIONS POSSESS CHEMICAL AND BIOLOGICAL WEAPONS TODAY THAN AT ANY OTHER TIME IN HISTORY. THE MAJORITY OF THESE NATIONS ACQUIRED THEIR CHEMICAL WEAPONS AFTER THE UNITED STATES BEGAN ITS MORATORIUM ON CHEMICAL WEAPONS PRODUCTION AND TESTING IN THE LATE 1960S. MOST OF THESE COUNTRIES ARE FOUND IN REGIONS OF STRATEGIC INTEREST TO US. SOME ARE ACQUIRING LONG RANGE DELIVERY SYSTEMS SUITABLE FOR CHEMICAL OR BIOLOGICAL WARHEADS. THE ENEMY IN THIS CASE MAY WELL HAVE A CHEMICAL MISSILE PENETRATION CAPABILITY WHICH CONSTITUTES A VASTLY SUPERIOR OFFENSIVE ADVANTAGE OVER OUR FORCES. THE 1972 BIOLOGICAL WEAPONS CONVENTION PROHIBITS POSSESSION OF BIOLOGICAL WEAPONS, BUT WE KNOW OF AT LEAST TEN COUNTRIES WITH BIOLOGICAL WARFARE PROGRAMS. MOST OF THE TEN ARE SIGNATORIES TO THE CONVENTION. CHEMICAL AND BIOLOGICAL WARFARE PROLIFERATION HAS OCCURRED AND CONTINUES.

THE SOVIET UNION CONTINUES TO HAVE THE WORLD'S GREATEST CAPABILITY FOR CONDUCTING CHEMICAL AND BIOLOGICAL WARFARE. YOUR SUPPORT OF OUR PRODUCTION OF A LIMITED BINARY CHEMICAL CAPABILITY PAVED THE WAY FOR THE SOVIETS ENTERING NEGOTIATIONS WHICH LED TO THE SIGNING OF THE WYOMING MEMORANDUM OF UNDERSTANDING LAST SEPTEMBER.

UNFORTUNATELY, CHEMICAL WARFARE IS NOT JUST AN EAST-WEST ISSUE. EVEN IN THE EVENT OF A CHEMICAL WEAPON AGREEMENT WITH THE SOVIET UNION, WE WILL CONTINUE TO FACE SERIOUS GLOBAL THREATS. THE "POOR MAN'S ATOMIC BOMB", CHEMICALS ARE CHEAP AND DEADLY. THIRD WORLD COUNTRIES ARE BUILDING THEIR OWN ARSENALS. CHEMICAL ARMS CONTROL MUST BE GLOBAL, COMPREHENSIVE AND MULTILATERAL, AND ALL CW-CAPABLE STATES MUST OPENLY PARTICIPATE IF WE ARE TO HAVE TRUE SECURITY. WE ARE ESPECIALLY CONCERNED ABOUT THE CHEMICAL WEAPONS

THREAT IN PLACES WHERE WE HAVE TREATY COMMITMENTS, A CONTINUOUS U.S. PRESENCE, AND A POTENTIAL OPPONENT WITH CHEMICAL WEAPONS.

CONGRESS HAS RECOGNIZED THAT OUR CURRENT UNITARY WEAPONS STOCKPILE IS NOT A CREDIBLE DETERRENT. TO CORRECT THIS SITUATION, THE 155MM BINARY CHEMICAL ARTILLERY ROUND HAS BEEN UNDER PRODUCTION SINCE 1987. THE BINARY BIGEYE BOMB IS SCHEDULED TO BEGIN PROCUREMENT NEXT YEAR AND THE MULTIPLE LAUNCH ROCKET SYSTEM BINARY CHEMICAL WARHEAD IS SCHEDULED TO BE COMPLETED IN 1992.

ALTHOUGH PROGRESS IN OUR DEFENSIVE PROGRAMS IS GOOD, WE MUST REALIZE THAT DEFENSE IN ITSELF IS NOT AN EFFECTIVE DETERRENT. THE DEGRADATION THAT COMES WHILE WEARING PROTECTIVE MASKS, GLOVES, OVERBOOTS AND OVERGARMENTS CUTS DEEPLY INTO AN INDIVIDUAL'S ABILITY TO PERFORM AND SUSTAIN HIS OR HER MISSION. SOLDIER/SAILOR PERFORMANCE AND AIR FORCE SORTIE GENERATION RATES CAN DROP DRAMATICALLY AND QUICKLY. THIS OFTEN MEANS OUR FORCES COULD NOT EFFECTIVELY EXECUTE THEIR ASSIGNED MISSION WHILE OPERATING IN A CONTAMINATED ENVIRONMENT. INABILITY TO RETALIATE IS EQUIVALENT TO LOSING A LARGE PORTION OF OUR COMBAT FORCE WHILE THE ENEMY IS UNENCUMBERED BY CB PROTECTIVE GEAR. POTENTIAL ADVERSARIES MUST RECOGNIZE THAT OUR CAPABILITY FOR CHEMICAL RETALIATION WILL CAUSE THEM TO EXPERIENCE THE SAME OPERATIONAL DEGRADATION. YOUR CONTINUED SUPPORT OF BOTH AN EFFECTIVE CHEMICAL RETALIATORY PROGRAM AS WELL AS A STRONG CHEMICAL AND BIOLOGICAL DEFENSIVE CAPABILITY FOR OUR PERSONNEL WILL PREVENT ANY CW-CAPABLE ADVERSARY FROM HAVING AN ADVANTAGE OVER OUR FORCES.

THE WORLD SITUATION

PRESIDENT BUSH CONTINUES TO STRONGLY PURSUE HIS LONG HELD POLICY OF OBTAINING A COMPREHENSIVE, TRULY GLOBAL AND MULTI-LATERAL CHEMICAL WEAPONS TREATY. HISTORY HAS DEMONSTRATED THAT ACHIEVEMENT

OF THIS OBJECTIVE REQUIRES THAT IT BE NEGOTIATED FROM A POSITION OF STRENGTH. THE DEPARTMENT FULLY SUPPORTS THIS POLICY. IN COMPLIANCE WITH CONGRESS' WISHES, A DEPARTMENT TREATY VERIFICATION RESEARCH AND DEVELOPMENT PROGRAM IS IN PLACE. A PLAN, INVOLVING A NUMBER OF AGENCIES, WAS SUBMITTED THIS PAST JANUARY TO CONGRESS. AS PART OF THIS PROGRAM WE CONTINUE TO INVESTIGATE PRECURSOR AND PRODUCTION EQUIPMENT PROLIFERATION AND THE BEST METHODS OF CONTROL.

ANOTHER CONTINUING SIGNIFICANT CONCERN IS THE CHEMICAL WEAPONS COMPLEX OF THE UNPREDICTABLE COLONEL QADDAFI. IN FACT, RECENT EVENTS HIGHLIGHT HIS EFFORTS TO PRODUCE A SIGNIFICANTLY LARGE STOCKPILE IN A FAIRLY SHORT PERIOD OF TIME. WE ARE AWAITING ASSESSMENTS OF THE RECENT FIRE ON THE RABTA PLANT'S FUTURE PRODUCTION CAPABILITY. RENEWED PRESS REPORTS OF LIBYA'S ACQUISITION OF AN INFLIGHT AERIAL REFUELING CAPABILITY TO EXTEND THE RANGE OF THEIR FIGHTER-BOMBER AIRCRAFT INDICATE A DIRECT THREAT TO OUR MIDDLE EASTERN ALLIES IN THE REGION AS WELL AS U.S. FORCES IN THE MEDITERRANEAN.

WE MUST CONCERN OURSELVES WITH IRAQ WHICH USED LARGE AMOUNTS OF CHEMICAL WEAPONS DURING THE IRAN-IRAQ WAR. WE ALSO BELIEVE SOME THIRD WORLD COUNTRIES ARE BUILDING SURFACE TO SURFACE MISSILES WHICH MAY EVENTUALLY HAVE A CHEMICAL WARHEAD.

FINALLY, WE PLAN TO REMOVE OUR EXISTING CHEMICAL UNITARY STOCKPILE FROM EUROPE. WE APPRECIATE YOUR CONCERN ABOUT ITS EFFECTS ON OUR DETERRENT CAPABILITY, AS WELL AS CONCERN FOR THE SAFETY AND SECURITY OF PERSONNEL CONDUCTING THESE REMOVAL OPERATIONS. WE BELIEVE, HOWEVER, THAT A MODERNIZED BINARY CAPABILITY BASED IN THE UNITED STATES PROVIDES FLEXIBILITY, SAFETY AND ADEQUATE DETERRENCE. IN COMPLIANCE WITH CONGRESSIONAL WISHES, WE WILL DEMONSTRATE AGENT DESTRUCTION AT THE JOHNSON ATOLL CHEMICAL AGENT DISPOSAL SYSTEM (JACADS), PRIOR TO MOVEMENT OF ANY MUNITIONS FROM GERMANY. THE FINAL DECISION ON MOVEMENT OF MUNITIONS TO

JOHNSON ATOLL CANNOT BE MADE UNTIL THE GLOBAL ENVIRONMENTAL ASSESSMENT IS COMPLETED. OUR POSITION CONTINUES TO BE THAT THESE MUNITIONS WILL BE A RESERVE AND BE THE LAST DESTROYED.

CONCLUSIONS

WHAT DOES THIS MEAN TO THE SECURITY OF THE UNITED STATES? FIRST, WE CANNOT SLACKEN MODERNIZATION OF OUR RELATIVELY MODEST CHEMICAL STOCKPILE. MODERNIZATION PLAYED A KEY ROLE IN THE FIRST REAL BREAKTHROUGHS AT THE GENEVA AND BILATERAL CHEMICAL TALKS; CONTINUED MODERNIZATION WILL HELP KEEP TREATY INITIATIVES HEADED IN THE RIGHT DIRECTION. SECOND, WHILE WE STRIVE FOR THE TOTAL ELIMINATION OF CHEMICAL AND BIOLOGICAL WEAPONS, WE MUST ALSO BE PREPARED FOR A WORLD IN WHICH A FEW OF THE CHEMICAL-CAPABLE NATIONS REFUSE TO SIGN OR COMPLY WITH A CHEMICAL WEAPONS TREATY AND SOME RETAIN A BIOLOGICAL WEAPONS CAPABILITY DESPITE THE BIOLOGICAL WEAPONS CONVENTION. FINALLY, OUR OLD UNITARY STOCKPILE NO LONGER POSES A CREDIBLE DETERRENT TO CHEMICAL ADVENTURISM TARGETED AGAINST U.S. FORCES OR OUR ALLIES. WE ARE COMMITTED TO ITS COMPLETE DESTRUCTION ONCE IT IS REPLACED BY A MUCH SMALLER STOCKPILE OF SAFE AND MODERN BINARY WEAPONS, WHICH INCLUDE THE DEEP STRIKE, PERSISTENT AGENT CAPABILITY REQUIRED BY OUR COMMANDERS IN CHIEF.

PROGRAM OVERVIEW

OUR FY91 BUDGET REQUEST FOR THE OVERALL CHEMICAL WARFARE, CHEMICAL AND BIOLOGICAL DEFENSE, CHEMICAL TREATY VERIFICATION RESEARCH AND DEVELOPMENT, AS WELL AS CHEMICAL DEMILITARIZATION AND RETROGRADE PROGRAMS IS $1.159 BILLION. 15.4% OF THE REQUEST IS FOR CHEMICAL WARFARE RETALIATORY PROGRAMS, 45.4% IS FOR CHEMICAL AND BIOLOGICAL DEFENSE PROGRAMS, 1.9% IS FOR CHEMICAL TREATY VERIFICATION RESEARCH AND DEVELOPMENT AND 37.3% FOR THE CHEMICAL DEMILITARIZATION AND RETROGRADE PROGRAMS.

CHEMICAL WARFARE RETALIATORY PROGRAM

AN EFFECTIVE CHEMICAL WEAPONS RETALIATORY CAPABILITY PROVIDES THE FIRST CRITICAL PILLAR FOR CBW DETERRENCE. TO PROVIDE CREDIBLE DETERRENCE, IT MUST DENY THE ENEMY ANY ADVANTAGE GAINED BY INITIATING CHEMICAL WARFARE. AN ADVERSARY MUST RECOGNIZE THAT OUR CAPABILITY TO RETALIATE WILL PLACE HIS FORCES IN A POSTURE AT LEAST AS CUMBERSOME AND DEGRADING AS OUR FORCES MUST FACE. THIS ADVANTAGE MUST BE DENIED THROUGHOUT THE ENTIRE BATTLEFIELD, FROM FRONT LINE COMBATANTS THROUGH SECOND ECHELON REINFORCEMENTS TO AIR BASES, LOGISTICS UNITS, AND COMMAND AND CONTROL SITES IN THE REAR AREAS. THIS ADVANTAGE MUST BE DENIED TO POTENTIAL ADVERSARIES IN ALL THEATERS OF CONFLICT.

OUR CURRENT UNITARY MUNITIONS DO NOT PROVIDE THAT CREDIBLE DETERRENCE. THAT SMALL PORTION OF THE OLD STOCKS WHICH CAN STILL BE EMPLOYED HAS ONLY LIMITED MILITARY USEFULNESS. IN ADDITION TO LIMITATIONS SUCH AS LACK OF LONG RANGE PENETRATION AND PERSISTENT CAPABILITIES, WE SIMPLY CAN'T IMPOSE THE HAZARD OF UNITARY MUNITIONS ON OUR FORCES SUCH AS THOSE MANNING AIRCRAFT CARRIERS. OUR PROGRAM TO PRODUCE BINARY CHEMICAL WEAPONS ENHANCES DETERRENCE AND MAKES IT CREDIBLE. OUR BINARY CW SYSTEMS WILL PROVIDE A SAFE, EFFECTIVE AND FLEXIBLE CW RETALIATION CAPABILITY. HOWEVER, WE REALIZE THAT WITHIN THE RESTRAINTS OF THE CURRENT BUDGET ENVIRONMENT AND LOOMING TREATY IMPACTS, THE SIZE OF OUR BINARY CAPABILITY WILL NEED TO BE REASSESSED. WE ARE CURRENTLY STUDYING VARIOUS BINARY MODERNIZATION OPTIONS FOR THE FUTURE.

CHEMICAL TREATY IMPLEMENTATION

WE REMAIN COMMITTED TO A TRULY GLOBAL, COMPREHENSIVE AND MULTILATERAL BAN OF CHEMICAL WEAPONS. I AGAIN ASK THAT YOU RECOGNIZE THE HISTORICALLY PROVEN EFFECTIVENESS OF NEGOTIATING FROM

A POSITION OF STRENGTH AND THE CONTINUING SIGNIFICANCE CHEMICAL WEAPONS WILL PLAY IN OUR WORLD. THE ABSOLUTE NECESSITY OF MAINTAINING AN EFFECTIVE CW RETALIATORY CAPABILITY, DURING THESE TURBULENT TIMES BEFORE AND DURING TREATY IMPLEMENTATION, CANNOT BE UNDERESTIMATED. GOOD PROGRESS IS BEING MADE IN OUR RECENTLY ESTABLISHED TREATY VERIFICATION RESEARCH AND DEVELOPMENT PROGRAM. THIS PROGRESS HAS BEEN SLOWER THAN ANTICIPATED , IN PART DUE TO THE COMPLEX ASPECTS OF MULTIAGENCY COORDINATION AS WELL AS UNCERTAINTIES IN THE NATURE OF THE BILATERAL AND MULTILATERAL TREATIES BEING NEGOTIATED. THIS FLUIDITY HAS RESULTED IN THE REQUIREMENTS BEING A MOVING TARGET. FOR EXAMPLE, PLANNING FOR THIS RESEARCH AND DEVELOPMENT WAS INITIATED BEFORE THE BILATERAL NEGOTIATIONS ACHIEVED MUCH IN THE WAY OF SUBSTANCE.

AS PART OF THE R&D PLAN, TECHNOLOGIES AVAILABLE NOW OR IN THE NEAR TERM FOR VERIFICATION ARE BEING IDENTIFIED. A KEY STEP IN THIS PROCESS, IS TO ESTABLISH THE SPECIFIC ROLE OF EACH CANDIDATE TECHNOLOGY. FOR EXAMPLE, THE USEFULNESS OF DETECTION DEVICES IN MONITORING FOR COMPLIANCE NEEDS TO BE ADDRESSED PRIOR TO COMMITMENT OF R & D RESOURCES. THE CHEMICAL VERIFICATION PORTION OF THE OVERALL CHEMICAL BUDGET IS ABOUT 1.9% FOR FY91. WE ARE DEVELOPING COST ESTIMATES FOR OTHER ASPECTS OF VERIFICATION SUCH AS PROCUREMENT AS WELL AS OPERATIONS AND MAINTENANCE.

CHEMICAL AND BIOLOGICAL DEFENSE PROGRAM

CHEMICAL AND BIOLOGICAL DEFENSE FORMS THE SECOND PILLAR OF DETERRENCE. SHOULD DETERRENCE FAIL, WE NEED TO PROTECT AND EFFECTIVELY SUSTAIN OUR FORCES IN THE EVENT THEY ARE ATTACKED WITH CHEMICAL OR BIOLOGICAL AGENTS, EVEN AS WE PREPARE TO RETALIATE. WE CONTINUE TO EXPLOIT JOINT AND COOPERATIVE PROCUREMENT PROGRAMS FOR DEFENSIVE EQUIPMENT AS A WAY OF CONTROLLING OUR COSTS. WE ALSO ARE INVESTING IN FUTURE TECHNOLOGY TO PROVIDE EFFECTIVE PROTECTION WITH MINIMAL ADVERSE IMPACT ON WARFIGHTING CAPABILITY. THROUGH

THIS INVESTMENT WE SEEK TO REDUCE SIZE, WEIGHT, AND OVERALL LOGISTICAL RESOURCES CURRENTLY REQUIRED TO SURVIVE AND FIGHT ON THE CONTAMINATED BATTLEFIELD.

WE SHOULD NOT CONSIDER REDUCING OUR CHEMICAL DEFENSE CAPABILITY BECAUSE "A CHEMICAL WEAPONS TREATY IS ON THE HORIZON". WE MUST EMPHASIZE THAT OUR FORCES ARE SUBJECT TO WORLDWIDE DEPLOYMENT, AND WE SHOULD NOT AUTOMATICALLY ASSUME THAT EVERY CW-CAPABLE NATION IN THIS WORLD WILL SIGN AND COMPLY WITH A CHEMICAL WEAPONS TREATY. IN ADDITION, THE CURRENT TREATY ROLLING TEXT CALLS FOR A TEN-YEAR IMPLEMENTATION PERIOD DURING WHICH OUR FORCES REMAIN VULNERABLE TO CHEMICAL ATTACK. PRESIDENT BUSH'S POLICY RECOGNIZES THAT WE NEED TO REMAIN CAPABLE OF SURVIVING, FIGHTING AND RETALIATING ON A CHEMICAL BATTLEFIELD UNTIL ALL CW CAPABLE STATES SIGN A TREATY. EXISTENCE OF A TREATY AND THE FUTURE ELIMINATION OF OUR CHEMICAL RETALIATORY DETERRENT WILL NOT DECREASE THE NEED TO DEFEND OUR FORCES FROM THE THREAT OF CBW ATTACK FROM NON-SIGNATORIES AND TREATY VIOLATORS.

RESEARCH AND DEVELOPMENT

IN RESEARCH AND DEVELOPMENT, WORK CONTINUES ON MUCH NEEDED NEXT GENERATION DEFENSE SYSTEMS. TO PROVIDE OUR FORCES WITH EFFECTIVE PROTECTION, WE ARE DESIGNING SYSTEMS TO DETECT, DEFEND AND PROTECT AGAINST THE GROWING NUMBERS OF CHEMICAL AND BIOLOGICAL AGENTS. OUR CURRENT R&D PROGRAMS WILL ALLOW US TO DEMONSTRATE AND BEGIN FIELDING IN THE MID-1990S NEW DETECTORS AND ALARMS, DECONTAMINATION SYSTEMS, AND MATERIEL (LIKE THE SOLDIER LIGHTWEIGHT CHEMICAL PROTECTIVE SUIT FOR ARMY LIGHT FORCES, AND COLLECTIVE PROTECTION FOR ARMORED SYSTEMS MODERNIZATION). WE WILL ALSO COMPLETE DEVELOPMENT OF AND FIELD NEW VACCINES AND PRETREATMENT DRUGS FOR IMPROVED PROTECTION, A SKIN DECONTAMINATION KIT, AN IMPROVED PRETREATMENT/ANTIDOTE FOR NERVE AGENTS, A PRETREATMENT FOR

BLOOD AGENT, AND ENHANCED MEDICAL DIAGNOSTIC AND TREATMENT CAPABILITIES.

AIR FORCE INITIATIVES WILL FOCUS ON COMPLETION OF TESTING AND FIELDING OF THE AIRCREW EYE/RESPIRATORY PROTECTION SYSTEM FOR THE AIR FORCE AND THE NAVY AS WELL AS DEVELOPMENT AND FIELDING OF A FIXED SITE DETECTION AND WARNING SYSTEM.

PROCUREMENT

THE THRUST OF THE DEFENSIVE PROCUREMENT PROGRAM IS TO PROVIDE ADEQUATE STOCKS OF READINESS-RELATED EQUIPMENT (LIKE MASKS, CHEMICAL AGENT ALARMS, VACCINES AND ANTIDOTES) WHILE IMPROVING THE ABILITY OF OUR FORCES TO SUSTAIN EFFECTIVE OPERATIONS IN A CONTAMINATED ENVIRONMENT. EVERY SOLDIER, SAILOR, AIRMAN AND MARINE IN OR DEPLOYABLE TO A CHEMICAL THREAT AREA HAS THE MINIMUM INDIVIDUAL EQUIPMENT NEEDED TO SURVIVE THE INITIAL CHEMICAL ATTACKS, BUT THIS EQUIPMENT MUST BE UPGRADED TO SUSTAIN COMBAT CAPABILITY.

IN 1991, THE ARMY WILL CONTINUE THEIR PROCUREMENT OF SIMPLIFIED COLLECTIVE PROTECTION EQUIPMENT SETS. THEY WILL CONTINUE TO PURCHASE THE CHEMICAL AGENT MONITOR, OR CAM. THE CAM BRINGS A MUCH NEEDED PORTABLE NERVE AND BLISTER AGENT SURVEY DEVICE TO THE FIELD. THE NBC RECONNAISSANCE SYSTEM PROGRAM CONTINUES WITH A RECENT DECISION TO BUY THE GERMAN NBC RECONNAISSANCE VEHICLE, WHICH IS BEING DEVELOPED AND PRODUCED AS A COOPERATIVE U.S/FRG PROGRAM. THIS WILL PROVIDE OUR FORCES WITH THEIR FIRST NEAR REAL-TIME, MOBILE CAPABILITY TO DETECT, IDENTIFY AND REPORT CONTAMINATION ON THE BATTLEFIELD. IT WILL ALLOW OUR GROUND FORCES TO BETTER EMPLOY THE CONCEPT OF CONTAMINATION AVOIDANCE BY USING STATE OF THE ART TECHNOLOGY. THE ARMY WILL BUY 8 VEHICLES IN FY 1990 AND 15 IN FY 1991. WE ARE CURRENTLY RE-ASSESSING REQUIRED QUANTITIES AND THE DISTRIBUTION PLAN. REGARDING THE IMPROVED

DRINKING TUBE FOR PROTECTIVE MASKS, A CONTRACT WAS AWARDED IN SEPT 89 FOR MODIFIED PROTOTYPES. TECHNICAL AND OPERATIONAL TESTING WILL BE COMPLETED BY SEPT 90. WE EXPECT TO AWARD A CONTRACT TO PROCURE 200,000 DRINKING TUBES IN THE FIRST QUARTER OF FY91.

THE AIR FORCE PROGRAM GOAL IS TO PROTECT INDIVIDUALLY AND COLLECTIVELY ALL OF THEIR PERSONNEL IN OR DEPLOYABLE TO CB THREAT AREAS--SOME 400,000 AIRMEN IN ALL. TO DATE, THEY HAVE FIELDED 140,000 NEW GROUND CREW MASKS WITH OVER 77,000 MORE ON CONTRACT FOR DELIVERY THIS YEAR. DELIVERY OF IMPROVED AIRCREW MASKS BEGIN IN 1991 WITH F-16, KC-135 AND C-130 UNITS RECEIVING THE FIRST QUANTITIES. THEY PLAN ON BUYING 30,000 NEW AIRCREW MASKS IN FUTURE YEARS. THE AIR FORCE HAS ALSO BEGUN FIELDING THE SECOND GENERATION GROUND CREW OVERGARMENT AND WILL BEGIN FIELDING ITS SECOND GENERATION AIRCREW OVERGARMENT IN 1993. ALONG WITH THE ARMY AND THE NAVY, THE AIR FORCE WILL ALSO ACQUIRE THE CAM.

AS IN THE PAST, THE AIR FORCE WILL CONTINUE PROCUREMENT OF COLLECTIVE PROTECTION SYSTEMS; SHELTER AREAS WHERE PEOPLE CAN WORK AND REST WITHOUT MASKS AND OVERGARMENTS. WITHOUT THESE, AIR FORCE BASES CANNOT SUSTAIN OPERATIONS IN A CHEMICAL ENVIRONMENT. MORE THAN 60 WORK CENTERS HAVE BEEN MODIFIED WITH THIS PROTECTION. ALSO, THEY HAVE INSTALLED 121 SURVIVABLE COLLECTIVE PROTECTION SYSTEMS (SCPS), WITH ANOTHER 43 PLANNED. THE AIR FORCE HAS RECENTLY REVISED THEIR COLLECTIVE PROTECTION PROGRAM, BASED ON THE RAPIDLY CHANGING SITUATION IN EUROPE AS WELL AS FUTURE BASE CLOSINGS AND REALIGNMENTS WHICH WILL RESULT FROM FORCE REDUCTIONS. IN THE FUTURE, PROTECTION ON AIR-BASES WILL RELY MORE ON MOBILE-TRANSPORTABLE, ROOM OR TENT LINER SYSTEMS, AS OPPOSED TO THE MORE EXPENSIVE AND LESS FLEXIBLE SCPS AND PERMANENT WORK CENTER MODIFICATIONS.

SUMMARY

WE STILL FACE A FORMIDABLE SOVIET CHEMICAL WARFARE CAPABILITY, WHICH SHOWS LITTLE EVIDENCE OF QUICKLY DECLINING. ALSO, THE SOVIET UNION HAS YET TO DECLARE THEIR BIOLOGICAL WARFARE CAPABILITY. WE HAVE A VERY REAL AND GROWING THREAT THROUGHOUT THE WORLD BECAUSE OF THE PROLIFERATION OF CHEMICAL AND BIOLOGICAL WEAPONS AND THE LINKAGE BY SOME NATIONS OF CHEMICAL ARMS CONTROL TO NUCLEAR ARMS CONTROL.

WE SUPPORT THE ADMINISTRATION'S EFFORTS TO NEGOTIATE A TRULY GLOBAL AND MULTILATERAL CHEMICAL WEAPONS BAN. HOWEVER, EVEN IF WE SHOULD ACHIEVE A CHEMICAL TREATY, WE WILL CONTINUE TO NEED A DEFENSIVE PROGRAM. UNTIL SUCH A BAN IS IN FORCE, AND INCLUDES ALL CW CAPABLE STATES AS PARTIES, WE WILL ALSO MAINTAIN A CREDIBLE CHEMICAL RETALIATORY CAPABILITY TO DETER CW ATTACKS ON OUR FORCES AND THOSE OF OUR ALLIES.

Senator EXON. Thank you, Dr. Richardson.

STATEMENT OF SUSAN LIVINGSTONE, ASSISTANT SECRETARY OF THE ARMY (INSTALLATIONS, LOGISTICS AND ENVIRONMENT), ACCOMPANIED BY WALTER L. BUSBEE, COLONEL, USA, PROGRAM MANAGER FOR CHEMICAL DEMILITARIZATION

Mrs. LIVINGSTONE. Thank you, Mr. Chairman. It is also a pleasure to be here this afternoon to discuss the status of the U.S. Chemical Stockpile Disposal Program. In addition to the other authorities that Dr. Richardson mentioned, I would also like to mention that Colonel Walter Busbee is also here with us today. He is the Program Manager for Chemical Demilitarization, seated behind me.

As you are aware, Mr. Chairman, we are rapidly approaching an historical moment in the Chemical Stockpile Disposal Program. We hope very soon to begin to destroy live chemical agents in our state-of-the-art disposal facility at Johnston Island. We anticipate that may begin as early as within the next 4 to 6 weeks.

This will initiate the operational verification testing portion of the Johnston Atoll Chemical Agent Disposal System, what we call JACADS, and, finally, the live agent testing, which is the goal of this program, and the live agent destruction, which is the goal of this program, will become a reality.

It is our hope that this will be a full success and the results of many hard years of work and effort on behalf of many individuals as well as the considerable costs that have gone in to get us to where we are today will not only benefit the people of the United States who live and work near chemical storage installations, but also the people of the world, as we work toward a multilateral and verifiable chemical disarmament treaty.

Readying the Johnston Atoll Chemical Agent Disposal System for operational verification tests, or OVT, has indeed been a very formidable task for the Army. Up until recently, our schedule, as you may recall, was to start OVT on April 16, 1990. We now project it will take an additional 2 to 4 weeks to actually begin the test program. We have experienced some mechanical and operational problems out at Johnston Island, which are not unusual for a chemical plant as complex as this particular facility. The problems are being solved, and our confidence in our ability to begin OVT within the next 2 to 4 weeks grows daily.

Nonetheless, I do want to assure you that the first priority and the first commitment of everyone involved in the Chemical Stockpile Disposal Program is safety to our workers and the public, as well as, protection of the environment. No destruction will occur at JACADS until the workers and equipment are ready to perform that mission safely.

Since last year, several major accomplishments have been achieved in this program. We have previously mentioned to you in my testimony that the disposal of the hallucinogen BZ at the Pine Bluff Arsenal in Arkansas, has been completed. We did complete this entire program without incident and destroyed 94,000 pounds of BZ at Pine Bluff.

Since the completion of that BZ destruction operation in October 1989, we also have disposed of all of the decontamination solutions, clean-up materials and hazardous waste and trash that were generated during the BZ disposal operations. That plant itself now is being decontaminated and readied for closure in June 1990 in accordance with the provisions of the Resource Conservation and Recovery Act.

Also, in 1989 we awarded two contracts. The first was awarded last June and is for the Chemical Demilitarization Training Facility which will be constructed at the Aberdeen Proving Ground in Maryland to train all workers for our disposal facilities.

We also awarded a contract in September 1989 for the construction and operation of the disposal facility at Tooele Army Depot, Utah, which is the first chemical disposal facility to be constructed in the United States.

Also, as a result of an agreement between President Bush and Chancellor Kohl of the Federal Republic of Germany, we are working on a program to remove the chemical munitions currently stored in Germany.

The size and complexity of this program continues to grow. This year, for example, in addition to concentrating on initiating the operational verification tests for JACADS and constructing the training and Tooele disposal facilities, the Army also restarted, and will continue, the test and development program for the cryofracture/incineration process. At the conclusion of this 18 to 24 month test, an assessment will be made to determine whether or not a cryofracture/incineration facility is needed.

The fiscal year 1991 program that is now before Congress presents even greater challenges and opportunities for a successful Chemical Stockpile Disposal Program as we move from the planning stages of this program to the execution phases of this program.

During this time frame, we plan to complete the operational verification test at JACADS and start full-scale operations of that facility. We also expect to complete the European retrograde program. And finally, we expect to award a contract for the construction and operation of the disposal facility which will be constructed at Anniston Army Depot in Alabama.

Last December, when I transmitted the Army's annual report to Congress on the Chemical Stockpile Disposal Program, I informed you that it was improbable that we would be able to meet the April 1997 disposal completion deadline. We now project that, for a variety of reasons including the decrement to the fiscal 1990 procurement program, increased environmental requirements, and the incorporation of lessons learned that we have gotten out of the Johnston Island experience, it is unlikely the program will be completed before December 1998. We have provided copies of the revised schedules to you and request your support for a legislative revision in the disposal date.

Ensuring that the Chemical Stockpile Disposal Program is successfully and safely accomplished is a team effort and includes not only the various offices within the Departments of Army and Defense and other Federal agencies, but also the Congress as well. We appreciate fully and thank you, Mr. Chairman, for your support and continued help in this extremely important national program.

That concludes my opening statement, Mr. Chairman, and we are pleased to answer any questions you may have.

[The prepared statement of Mrs. Livingstone follows:]

STATEMENT BY

MRS. SUSAN LIVINGSTONE

ASSISTANT SECRETARY OF THE ARMY

(INSTALLATIONS, LOGISTICS AND ENVIRONMENT)

Mr. Chairman and Members of the Committee, it is a pleasure for me to appear here today to discuss the United States Chemical Stockpile Disposal Program (CSDP). With me is Major General Louis Del Rosso, Director of Space and Special Weapons, Office of the Deputy Chief of Staff for Operations and Plans and the Director of the Chemical Retrograde Task Force. Also with me is the Program Manager for Chemical Demilitarization, Colonel Walter Busbee, soon to be promoted to Brigadier General. I mention this fact since Congress has directed that the management of the CSDP be under a general officer. We appreciate the support you and your committee members have provided to this important program and look forward to continuing to work closely with you as we progress through safe and environmentally sound disposal of this nation's stockpile of unitary chemical weapons.

BACKGROUND AND OBJECTIVE OF THE CHEMICAL STOCKPILE DISPOSAL PROGRAM

Since World War I, the United States has maintained a stockpile of unitary chemical weapons as a deterrent against enemy use on our troops. Unitary chemical weapons production continued in the United States until 1969 when President Nixon directed a unilateral halt to our production. Since no unitary chemical weapons have been produced since that date, the newest U. S. unitary chemical munitions are over 21 years old.

Initially, as these old weapons became obsolete, they were destroyed by the then accepted methods of ocean burial and open pit burning. In 1970, this practice was halted, because ocean dumping and open pit burning were no longer considered environmentally safe or acceptable methods for destroying chemical weapons. Since 1970, as other portions of the chemical stockpile were classified as obsolete and no longer militarily useful, the Army destroyed those munitions by chemical neutralization and incineration in complex state-of-the-art (for that time) plants. This destruction took place at Rocky Mountain Arsenal, Colorado, and Tooele Army Depot, Utah, in the 1970's and resulted in no harm to the workers, public or the environment. It was during this period, that the Army recognized that chemical neutralization was an inferior destruction process to incineration in terms of overall efficiency and the amount of waste produced.

In 1982, the Department of the Army determined that the nerve-agent-filled, M55 rocket was no longer militarily useful and should be destroyed. Since there are almost a half million of these rockets stored at six chemical storage sites, the Army started a program for destroying these rockets, calling it the M55 rocket disposal program. In 1985, at the Army's request, Congress approved funds to build the first of these M55 rocket disposal facilities at Johnston Island.

In late 1985, Congress passed Public Law 99-145, the FY 1986 Defense Authorization Act. This law directed, in part, that the Department of Defense undertake the following actions:

- destroy at least 90% of the United States stockpile of lethal chemical agents and munitions by September 30, 1994;

- provide maximum protection for the environment and public;

- dismantle disposal facilities when chemical disposal is completed;

- set up a management organization headed by a general officer to conduct the disposal program; and

- fund the disposal program in a separate Department of Defense account.

Public Law 99-145 was subsequently amended by Public Law 100-456, which extended the disposal completion date to April 30, 1997.

Public Law 99-145 required a complete revision of the Army's M55 rocket disposal program. The Chemical Stockpile Disposal Program (CSDP) was established for the purpose of destroying the complete unitary chemical stockpile.

The Office of the Program Manager for Chemical Demilitarization (PMCD), headquartered in the Edgewood area of Aberdeen Proving Ground, Maryland, was created in 1986 to carry out the CSDP. The PMCD developed an initial disposal concept plan in March 1986 to meet the requirements of the law. That plan was subsequently revised in 1988 and forwarded to the Congress as an implementation plan. The PMCD also initiated a programmatic environmental impact statement (PEIS) for destroying the stockpile within the United States. The PEIS was completed in January 1988 and a Record of Decision was made in February 1988 to destroy the chemical agents and munitions on-site without transporting them off the installations.

The Department of the Army, as the Department of Defense's Executive Agent for this program, has proceeded on a necessarily lengthy but orderly path to ensure a safe, complete disposal program. As this testimony details, this path has included extensive environmental research and impact assessments; detailed development of evaluation, testing and emergency procedures; comprehensive Federal, state and local community involvement; development of extensive safety and security features; and design, construction and, in the near future, operation of a full-scale disposal facility at Johnston Island in the Pacific, which will serve as a model facility for future chemical agent disposal plants in the United States.

Today we are nearing the beginning of what the primary objective of the CSDP is all about - destruction of the unitary chemical stockpile. The Johnston Atoll Chemical Agent Disposal System (JACADS) is scheduled to go "hot" within the next six weeks with the destruction of nerve-agent-filled (GB) M55 rockets. This is a critical moment for the program and one which we approach with confidence that the mature technological process we will use will ensure safe and efficient chemical destruction. Schedules tend to become important in a program such as this, but every individual associated with the Chemical Stockpile Disposal Program is committed to safety and environmental protection first. No destruction will occur at JACADS until we can certify the readiness of the people and the equipment.

The mission is clear. The tasks are difficult, but doable. The Army plans to construct eight chemical disposal facilities within the United States modeled on the JACADS facility and tailored to the chemical stockpiles stored at each location, if supported by site-specific environmental impact statements. The sections that follow discuss disposal locations, schedules and other important aspects of the Chemical Stockpile Disposal Program.

CHEMICAL AGENT MUNITIONS DISPOSAL SYSTEM

The Chemical Agent Munitions Disposal System (CAMDS) is the Army's prototype chemical disposal facility located at Tooele Army Depot, Utah. CAMDS, which has been operational since September 1979, was designed and built as a research, development and demonstration facility to test procedures and equipment for chemical agent destruction. The facility has been used to test the munition processing equipment; furnaces; and pollution abatement and control systems with actual chemical-filled munitions prior to placement in the Johnston Atoll Chemical Agent Disposal System (JACADS). The furnace systems of the CAMDS facility are approximately one-third the size of JACADS furnaces.

Testing in FY 1991 will continue in support of the JACADS facility. Incineration of mustard in the liquid incinerator, along with testing of the multipurpose demilitarization machine and the metal parts furnace using mustard-filled munitions, will take place in FY 1991. Testing in support of the Resource Conservation and Recovery Act requirements using nerve agent surrogates in the liquid incinerator will also be conducted.

Several tests to support the cryofracture program will also be conducted at CAMDS in FY 1991. Included in the CAMDS test schedule is incineration of:

- cryogenically cooled mixtures of metal parts and agent

- ambient temperature agent from bulk containers in the deactivation furnace

JOHNSTON ATOLL CHEMICAL AGENT DISPOSAL SYSTEM

The Johnston Atoll Chemical Agent Disposal System (JACADS) is very important to the program because it is the first of nine chemical disposal facilities that will be used to destroy this nation's unitary chemical stockpile. Throughout the past year, the Army has been testing the individual plant equipment and systems. We have recently started our operational readiness evaluation which is designed to determine when the facility will be ready to start destroying chemical weapons. We hope to start soon, but no agent will be introduced into JACADS until we are convinced that the process is working safely and all of the workers are fully trained and have demonstrated the necessary proficiency.

Since JACADS is a complex chemical industrial facility and the first of its kind to be built, it is natural to expect some technical problems, and we have had them. The Army has been working closely with the contractor and its parent headquarters to ensure that the problems are solved and the solutions tested prior to certifying that the facility is ready for operation.

The first scheduled operation at JACADS is the Congressionally-mandated Operational Verification Test (OVT). The test will verify that the disassembly/incineration process can safely destroy the different agents and types of chemical munitions in the United States' unitary chemical stockpile while meeting all Federal and state safety and environmental requirements. The purpose of this test is to verify the process, not to meet specified through-put rates. OVT is scheduled to run for 16 months and is divided into four phases. During each phase, a different chemical agent or different type of chemical munition will be destroyed.

OVT is an important landmark because the successful live agent destruction at JACADS and the verification of the destruction process will allow the program to continue with its plan to operate other disposal facilities within the United States.

The JACADS plant will destroy 6.6% of the agent tonnage in the U. S. chemical stockpile.

CHEMICAL DEMILITARIZATION TRAINING FACILITY

In June 1989, the Army awarded a contract to General Physics of Columbia, Maryland, to construct and operate a Chemical Demilitarization Training Facility (CDTF) at Aberdeen Proving Ground, Maryland. This facility will be used to train the managers and workers of all future chemical disposal facilities. Trainees will use the same type of equipment found in the actual plants, with the exception of the furnace systems which will be simulated. The furnace systems are costly, not necessary to the training program and would require extensive environmental permits to be developed.

The workers will be taught the correct operations of each piece of equipment and steps necessary to correct system failures. Control systems will operate as in the real plants, allowing workers to train under simulated plant upset conditions. Only training munitions and simulated agent will be used for training in this facility. The first plant to use workers trained at this facility is under construction at Tooele Army Depot.

TOOELE ARMY DEPOT DISPOSAL FACILITY

In September 1989, the Army awarded a contract to EG&G, Defense Materials Group, Inc., of Falls Church, Virginia, to construct, test, operate, and finally close down a chemical disposal facility at Tooele Army Depot, Utah. Construction is currently about 7% completed. This is the first of the chemical disposal facilities to be constructed within the United States. Tooele was chosen as the first site because it has the largest share of the nation's stockpile - 42% by agent weight - and therefore will be in operation longer than any other scheduled disposal facility. The design of the facility has been significantly influenced by the lessons-learned from the JACADS facility. It will have two liquid incinerators to destroy agent and a container-handling building to receive the munitions in a specially designed overpack container. The facility is scheduled to commence operations in early 1993.

REMAINING SITES

The program calls for construction of disposal facilities at each of the remaining seven chemical storage sites within the United States. The next facility to be constructed will be at Anniston Army Depot, Alabama (7.1% by agent weight), in 1991. The FY 1991 budget requests $64 million for construction of this facility and associated depot support requirements. Because of budgetary constraints, two other facilities, originally scheduled for 1991, have been moved to 1992. These are Pine Bluff Arsenal, Arkansas (12% by agent weight), and Umatilla Depot Activity, Oregon (11.6% by agent weight). Contract awards for these two plants were originally scheduled for late in FY 1991 and now are scheduled for June 1992. Incidently, Pine Bluff Arsenal was the site of our recently completed, highly successful program to destroy the incapacitating agent BZ and the waste material associated with BZ. The method for destruction was incineration, the same as that used by JACADS.

The remaining four plants are scheduled for construction in 1993. They are Aberdeen Proving Ground, Maryland (5% by agent weight); Lexington-Blue Grass Army Depot, Kentucky (1.6% by agent weight); Newport Army Ammunition Plant, Indiana (3.9% by agent weight); and Pueblo Depot Activity, Colorado (9.9% by agent weight). This schedule is different from that included in the March 1988 plan. An explanation of the reason for the change in the schedule is provided in the next section.

PROGRAM SCHEDULE REVISION

In our last Annual Report on the Chemical Disposal Program, submitted to Congress in December 1989, the Army informed the Congress that meeting the April 1997 completion date was improbable. We have now determined that the Congressional mandate cannot be met without circumventing safety and environmental requirements. The $37 million decrement to the FY 1990 procurement program has delayed the scheduled completion of the Tooele Army Depot disposal facility. That facility's operation schedule is also affected by the State of Utah's ruling that, while it reviews the data from each trial burn, disposal operations can only be run at 50% capacity. Finally, the Tooele schedule is also affected by the incorporation of lessons-learned from JACADS. One critical lesson-learned is that it takes 18 months to test the equipment, train the operators and ensure that the plant is safe for agent operations, not 12 months as was expected.

Because of these changes, we have developed a revised schedule that is attached as Table 1. The new schedule shows that destruction of all the chemical munitions should be completed at the end of 1998. Closure of some of the facilities will take place in 1999. This revised schedule reflects our actual experience to date in terms of the amount of time required for completing environmental documentation and facility systemization, as well as incorporates the stringent RCRA-mandated requirements, based on the permit issued by the State of Utah for operation of the Tooele Army Depot facility. Even though this is a more realistic schedule, I must place a cautionary note here -- the schedule does not account for major delays due to system failures, litigation, or other lessons-learned once JACADS begins actual operation. Should additional schedule revisions be required, we will keep Congress fully informed.

Earlier, I stated that one disposal facility will be constructed in 1991 (Anniston Army Depot), two in 1992 and four in 1993. Many requirements, such as designs and environmental documentation, must still be completed prior to constructing these facilities according to the new schedule. Again, we will keep the Congress informed of our progress.

This revised schedule is compatible with current United States chemical weapons arms control negotiation positions. The Soviet Union and the United States are contemplating signing a bilateral chemical arms agreement this summer. The terms of the agreement being discussed are for both nations to destroy 80% of their chemical stockpile as soon as possible. The multilateral chemical treaty on which the U. S. is also negotiating, however, will probably take a few more years. In either case, the revised schedule is in-line with our negotiation positions.

We recognize the importance of schedules and are committed to meeting them. Nonetheless, we are dealing with a complex technology and must expect to experience technical problems. As I stated previously, of paramount concern in this program is safety both for people and the environment. This is a program which will be ready when it is ready.

SAFETY

It is my commitment, and I know that Colonel Busbee agrees, not to start destroying chemical munitions until we are certain JACADS is ready. When we do start operating, we will do so only on a schedule that is prudent for the tested system and workers. To do otherwise and risk an accident would be foolish and may prove to be more damaging to the overall schedule.

We know that this is a highly visible program and that there is strong interest in ridding this nation of its obsolete chemical stockpile as soon as possible; nonetheless, it is important to remember that safety is the primary objective for this program, not meeting schedules or maintaining minimal costs. We all want to reduce costs and meet international commitments, but not at the risk of jeopardizing the safety of our workers, the public and the environment.

ENVIRONMENTAL REQUIREMENTS

In order to construct and operate chemical disposal facilities, the Army has developed extensive environmental analyses. First, since this is a major action that has the potential to affect the environment, the disposal program falls under the requirements of the National Environmental Policy Act (NEPA). To comply with NEPA, the Army completed a programmatic environmental impact statement (PEIS) for the overall program. Then, based on that document, site-specific EISs will be developed for each of the chemical disposal sites.

The PEIS was completed in January 1988 and the Army made a Record of Decision that, based on the risk analysis, chemical disposal facilities would be constructed at each of the eight sites. This means that there will be no requirement to transport the chemical munitions off the military installations where they are currently stored for destruction. The Army made a commitment to the Congress that we will conduct additional studies and take a fresh look at the on-site disposal decision before doing the site-specific environmental impact statements. Once this is done, we will then be in a position to either validate or reject the on-site decision. The site-specific EIS will then be developed for the site. This process has already been completed at Tooele Army Depot.

In addition to NEPA, the Resource Conservation Recovery Act (RCRA) requires the completion of additional environmental documents. Since the disposal facilities involve hazardous waste, they must have approved RCRA permits prior to construction. These permits are very comprehensive and normally take 18-24 months to complete. In all cases, the primacy for approval of RCRA permits rests with the states. Also, once the facilities are constructed, extensive trial burns are required for each of the furnaces and for each type of chemical agent. The emissions from these trial burns must meet state and Federal standards in order for the plant to receive an operating permit.

The Toxic Substance Control Act (TSCA) also plays a role in the chemical disposal program. One munition, the M55 rocket, has small quantities of PCB embedded in its fiberglass shipping and firing tube. In order to meet the requirements of TSCA, significant changes to the deactivation furnace system were required. The Environmental Protection Agency (EPA) gave permission for JACADS to start operations based on results from two separate trial burns. Another trial burn will be conducted later.

Finally, the stack emissions for the eight continental United States (CONUS) facilities must meet the requirements of the Clean Air Act (CAA), including permitting. Since the disposal plants do not discharge contaminated water, compliance with the Clean Water Act is not a problem.

To summarize, the environmental requirements for the Chemical Stockpile Disposal Program are quite extensive and time consuming. Several years of environmental work (2 to 3 years) must be completed prior to construction of a chemical disposal facility.

EMERGENCY PREPAREDNESS

Emergency preparedness is also an important component of the Chemical Stockpile Disposal Program. When the Record of Decision was made for the programmatic EIS, a significant reason for choosing on-site disposal was the ability to better prepare for an emergency caused by a chemical accident at a fixed site rather than along a transportation corridor.

To mitigate any effects of chemical accidents at the eight chemical storage sites, substantial work is required to enhance the emergency response capabilities of the communities. The Army has signed a Memorandum of Understanding with the Federal Emergency Management Agency (FEMA) to help the communities upgrade their capabilities.

The role of the two agencies is to provide information, assistance, guidance and funding for the states to complete the task. Emergency preparedness is the responsibility of the states, not FEMA or the Army. The states will make the final decisions on how to upgrade their capabilities and what equipment is needed.

The Army and FEMA co-chair an Emergency Preparedness Steering Committee, which is responsible for oversight and review of the complete program. Its functional arms, six subcommittees, include representation from the Army, FEMA, Environmental Protection Agency, Department of Health and Human Services and the affected states and are responsible for the following:

- Planning Subcommittee - Responsible for developing documentation for guiding the actions of all the appropriate agencies. These documents include the Emergency Preparedness Management Plan, Planning Guidance and the Standards and Criteria Manual for equipment. This subcommittee also generates policy recommendations for the Steering Committee.

- Exercise Subcommittee - Responsible for formulating exercise plans, scenarios, and schedules for the states, communities and Army installations. Oversees the exercise program.

- Training Subcommittee - Establishes the training guidelines, then helps provide the necessary training to all emergency responders for the states. Incorporates medical, fire, security, and decontamination functions. Works closely with the Exercise Subcommittee.

- Public Affairs Subcommittee - Develops the plan for educating the populace on actions to take prior to, during and after a chemical emergency. Promotes confidence in emergency response capabilities of the Army and the states. Assists the states' public relations programs. Formulates guidelines for the Joint Information Center that would be used during emergencies. This is the single center that is the source of information to the public and the media.

- Computer Applications Subcommittee - Develops the requirements of the automation system used at Army and state emergency operation centers. Identifies the hardware and software necessary to operate the system. Integrates the on-site and off-site components so that both systems are compatible. As a minimum, alert, warning, and command and control capabilities must be incorporated in the automated system. Determines which dispersion model to use for predicting movement of an agent.

- Re-entry and Recovery Subcommittee - Helps establish the criteria for determining when buildings, soil, plants, water, etc., are considered safe to use in the unlikely event that they become contaminated with chemical agents.

To date, $63.8 million has been appropriated by Congress to support emergency preparedness. Our FY 1991 budget includes a request for $25.3 million to support the emergency response program. Funds for the emergency preparedness program are provided to the states through FEMA's Comprehensive Cooperative Agreement. The states negotiate their requirements with FEMA and once the agreement is completed, funds are transferred to the states to do the necessary planning, training, and equipment procurement. FEMA and the Army provide contractor assistance to the states and closely monitor their activities to ensure that funds are used appropriately.

As the states continue to plan and refine their roles in emergency preparedness, we anticipate that their resource requirements will grow. After the majority of the equipment is procured (sirens, tone alert radios, computer systems, fire protection, chemical protective equipment, etc.), the emergency response funds will be used for training and exercises. Each site will be conducting periodic full-scale exercises involving the Army installation, the local communities and the state.

In addition, periodic chemical stockpile emergency preparedness program conferences are held to discuss all of the ongoing actions and to share concerns from the states. The first conference was held at Park City, Utah, in November 1989. The second is scheduled for May in Bend, Oregon.

FINANCIAL SUMMARY AND FY 1991 BUDGET

To date, from FY 1985 through FY 1990, $1.1 billion has been appropriated for the Chemical Stockpile Disposal Program, including $121 million for construction costs in the Military Construction, Army (MCA) account. Attached as Table 2 is a summary of the FY 1991 budget request for the Chemical Agent and Munitions Destruction, Defense account. The fiscal year 1991 request of $354 million provides operations and maintenance, and procurement funding to maintain the program on course to complete chemical disposal operations in 1998. This request includes funds to continue operations at the Chemical Agent Munition Disposal System (CAMDS); complete the Operational Verification Test at the Johnston Atoll Chemical Agent Disposal System (JACADS); begin training at the Central Demilitarization Training Facility (CDTF); and continue to implement the Emergency Preparedness Program.

The FY 1991 request also includes funding to initiate the program and support integration contract to provide technical and managerial support to the Program Manager for Chemical Demilitarization as well as funds to complete the European retrograde project. Further, this request includes funding for the acquisition of equipment for the disposal facilities at Tooele Army Depot, Anniston Army Depot, Pine Bluff Arsenal and the CDTF.

Although not part of the Chemical Agents and Munitions Destruction, Defense account, $76.3 million is being requested in the Army's FY 1991 MCA account for the construction of chemical disposal facilities. Included is a project to construct a disposal facility at Anniston Army Depot, Alabama. The MCA budget also includes funding for projects in support of the Chemical Stockpile Disposal Program at Anniston Army Depot and Tooele Army Depot.

MANAGEMENT OF CHEMICAL STOCKPILE DISPOSAL PROGRAM

The Army is the Department of Defense Executive Agent for the Chemical Stockpile Disposal Program. Within the Army, the Assistant Secretary of the Army (Installations, Logistics and Environment) has the responsibility for executive-level oversight of the program. In accordance with Public Law 99-145, in May 1986, the Program Manager for Chemical Demilitarization (PMCD) was formed. The PMCD is authorized 13 military and 378 civilians to manage and execute the complete destruction program. This includes, but is not limited to, designing the destruction process; constructing, testing and operating the facilities; developing environmental documents; developing and operating monitoring instruments; ensuring safety, environmental compliance and quality control; and providing resource management and contract administration services.

Most of the work done in the design, construction and operation of the disposal facilities, as well as studies to support environmental safety and engineering requirements, is performed by contractors. Soon, a Program and Integration Systems contractor will be competitively chosen to support the Program Manager in executing the program. The contractor will provide technical, program management and program integration support in the central office at Aberdeen Proving Ground, Maryland, and at all of the field disposal sites.

All of the chemical disposal facilities will be government-owned, contractor-operated plants. The eight follow-on plants will be based on the JACADS design and will use the same destruction process. This means that all the processing equipment must be identical, except for site-specific modifications. To ensure that all the equipment is similar, we have awarded contracts to Bechtel International and the Stearns-Roger Division of United Engineers and Constructors to provide the major equipment for the facilities. Also for each facility, a single systems contractor will be competitively chosen for constructing the facility, installing and testing the equipment, operating the facility, and finally dismantling the buildings.

A special aspect of the management of the program is the responsibility for running the plant. After many reviews, the decision has been made that the Program Manager is best suited to run the plant since his organization will have designed and constructed the facility and retains the major technical knowledge. Each installation commander will provide the necessary support for security, safety, emergency response and transporting the munitions to the disposal facility.

PROGRAM OVERSIGHT

The international community, other federal agencies, the Congress, the states and the public all have an interest in the Chemical Stockpile Disposal Program.

The National Academy of Sciences' National Research Council acts as an independent overseer of the program and has provided valuable advice to us. The committee recently spent a few days on Johnston Island reviewing our JACADS facility. Although we have yet to receive their report, overall they seemed pleased with the facility.

The Army Audit Agency has several on-going audits involving the program. These audits include technical aspects of the program as well as funding and contracting matters.

The Congress currently has two General Accounting Office teams investigating the program. The first is looking at the complete program and the second is concentrating on JACADS. Their reports have not been published. Also, a House Appropriations Committee (HAC) Surveys and Investigations team is investigating the broad aspects of the program and will report to the HAC. That report will include information concerning the follow-on use of disposal facilities and the cryofracture testing program.

FACILITIES REUSE

The FY 1990 Defense Appropriations Conference Report directed the Army to investigate and report on the feasibility and desirability of follow-on uses of the chemical disposal facilities after they have completed destroying the chemical stockpile. To ensure objectivity, this study will be accomplished with a contract and will look at all possible follow-on uses, both military and non-military, for these facilities. The study also will address potential cost/design changes which would be required for follow-on use. The report should be available at the end of the year.

However, Public Law 99-145 requires the design and construction of facilities to destroy chemical munitions and then to dismantle those facilities after they have completed their tasks. Unless that law is changed, the Army will comply and dismantle the facilities. The multilateral ban on chemical weapons currently being negotiated also requires that all chemical weapons destruction facilities be destroyed once all stocks are eliminated.

CRYOFRACTURE

Last year at this time, the Department of Defense had stopped all work on the development of the cryofracture process; however, in accordance with the FY 1990 Defense Authorization and Appropriations Acts, the Department has restarted the development of the cryofracture/incineration process. A letter contract was awarded in January 1990 to General Atomics to develop the test plans and restart the test program. The full contract is being negotiated and should be awarded soon.

The 18-24 month test program will involve work at the General Atomics plant in California, at the Greenfield Test Range in Miramar Naval Station, at the Chemical Agent Munitions Disposal System (CAMDS) in Utah, and possibly at one of the chemical surety laboratories. We hope to provide answers to knowledge gaps in this process and gather data that can be used to compare cryofracture with the disassembly/incineration process.

Separate contracts will be awarded to start the environmental work and for the process design. At this time, there is no intent to construct a cryofracture disposal facility and no funds have been programmed for such a facility. At the end of the comparison efforts referred to above, there will be an assessment made to determine whether a cryofracture facility is needed.

The focus of my testimony will now shift to two programs that are not specifically part of the CSDP but are inextricably linked to it -- chemical retrograde and chemical treaty negotiations.

CHEMICAL MUNITIONS RETROGRADE

Public Laws 99-145 and 100-456 require the destruction of the complete United States unitary chemical stockpile. Included in the unitary chemical stockpile are approximately 100,000 munitions currently stored within the Federal Republic of Germany (FRG). Only 155mm and 8-inch chemical artillery projectiles containing either GB or VX chemical agent are stored within the FRG. These munitions were introduced into the FRG in 1968 in accordance with procedures and requirements governing the handling of munitions at that time. Since 1968, they have been stored, maintained and monitored at their present location without incident. They are in excellent condition and therefore are safe to move.

To help determine where the chemical munitions should be destroyed, the State and Defense Departments verbally queried the FRG Government whether destruction of those munitions should be done on-site. The Government of the FRG refused to permit destruction of the chemical munitions in the FRG.

During the 1986 Tokyo Economic Summit, former President Reagan and Chancellor Kohl reached an understanding that the chemical munitions would be removed from Germany by the end of 1992. Subsequently, at Chancellor Kohl's urging, President Bush encouraged the Department to accelerate the timetable for this retrograde project. The Army has a major role in this planned movement. A task force was created, plans written, and now equipment is being procured and training is being conducted.

On March 8, 1990, most of the plans for the movement within the FRG were released in a press conference that was held at Pirmasens, Germany. The palletized chemical munitions will be taken from storage and placed into steel containers. These containers will then be placed into ammunition containers called MILVANs. Both containers meet the International Maritime Dangerous Goods (IMDG) code for transporting this type of hazardous cargo.

Once the MILVANs are loaded, they will be trucked to Miesau Army Depot by Army vehicles. Actual routes and security plans are still being coordinated with the FRG. At Miesau, the MILVANs will be loaded onto German railcars. The trains will be controlled by Germans, but the chemical munitions will remain under the custody of U. S. Army personnel. Security, medical assistance and emergency response for the complete movement within the country will be provided by the FRG Government. Extensive planning has gone into ensuring full protection of the public and the environment throughout the move of the munitions in Germany.

The trains will transport the MILVANs to the port of Nordenham, located in the northern part of the country. There, the MILVANs will be transloaded into the holds of two U. S. Military Sealift Command vessels. Once the ships are loaded and move into international waters, the rest of the movement will be under complete United States control.

The preferred destination for the chemical munitions is Johnston Island. Because of past reactions to bringing overseas chemical stocks back to the continental United States (CONUS) and the additional risks involved in using a CONUS destruction site, the Johnston Island facility is considered the reasonable place to destroy these stocks. The final decision, however, cannot be made until the Global Commons Environmental Assessment is completed, pursuant to Executive Order 12114. This classified document will assess the environmental consequences of transporting the chemical munitions on different ocean routes. It will explain that removal of the munitions by aircraft is not feasible. Once the document is completed, the Joint Chiefs of Staff (JCS) will make the route decision.

A separate supplemental environmental impact statement (EIS) has been drafted for assessing the environmental consequences of receiving, storing, and destroying the chemical munitions from FRG on Johnston Island. A public meeting was held in Honolulu on this document on March 20, 1990. Public comments were generally negative toward bringing the chemical munitions into the Pacific Basin and to Johnston Island. The Sierra Club and Greenpeace made substantial comments. Answers to all the comments will be incorporated into the final supplemental EIS. This document will also be completed and a decision made prior to the start of the movement phase of the retrograde operation.

Additionally, Public Law 101-165, the 1990 Defense Appropriations Act, precludes the expenditure of more than $10 million on the retrograde project until the Secretary of Defense certifies that JACADS has started destroying chemical agent and there is adequate storage space on Johnston Island for the receipt of the FRG stocks.

Plans still call for the retrograde project to be initiated this year. If the important milestones of completing the environmental documents and operating JACADS are not met or safety is jeopardized, the project will be delayed.

CHEMICAL TREATY NEGOTIATIONS

The Chemical Stockpile Disposal Program (CSDP) contributes to the reduction of chemical weapons worldwide. As you know, President Bush is strongly committed to chemical disarmament and has expressed continued personal interest in the progress of this program. While a comprehensive multinational chemical treaty is still being negotiated in Geneva, the United States and the Soviet Union have been actively negotiating and may sign a bilateral agreement as early as this summer to destroy up to 80% of our respective chemical stockpiles.

Although the CSDP was undertaken as a United States unilateral initiative in support of chemical disarmament, clearly the program is of major interest to the United States and Soviet negotiators. In this regard, the Army has been working very closely within the Department of Defense, as well as with the Arms Control and Disarmament Agency, to ensure that all treaty requirements are, in fact, executable within the time frames specified. We also are involved in assisting the U. S. negotiators in verification processes for the destruction of these weapons.

Given the U. S. lead in chemical disposal technology, the Soviet Union has expressed interest in our process for destroying chemical munitions. Representatives from the Office of the Program Manager for Chemical Demilitarization were recently included in the discussions with a Soviet delegation in Geneva to discuss our disposal process. Later this month, we will again send representatives to Geneva to further discuss our disposal technology with Soviet experts and to learn about their disposal process.

The U. S. has also extended an invitation for Soviet technicians to visit Johnston Island later this year to see first-hand the U. S. disposal process used in the Johnston Atoll Chemical Agent Disposal System (JACADS). Exchange of data concerning our respective disposal processes is already occurring.

A separate series of visits by United States and Soviet negotiators is also being planned to chemical storage sites within the two countries. The purpose of these visits is to develop procedures to verify the data being exchanged on chemical stockpiles. The first of these visits within the United States will be to Tooele Army Depot, Utah, in early June 1990.

SUMMARY

The Army takes its mission of destroying the nation's chemical munitions very seriously. The Chemical Stockpile Disposal Program will continue to evolve as more experience is gained and more facilities are built. Although schedules are useful management tools, the Army will only operate disposal facilities when the facilities are ready and we have completed all the necessary mechanical, technical and safety checks. Safety for our workers, the public and the environment is the primary goal for the program.

The Congress has understood the complexity of this important task from the onset of this program and the Army appreciates the funding and legislative support it has received.

TABLE 1
REVISED CHEMICAL DISPOSAL SCHEDULE

Location	Start Phase I Review	Start Facility Constr	Start Opns	End Opns
JACADS	N/A	1986	May 90	Jul 94
Tooele Army Depot	Aug 88	Oct 89	Oct 93	Dec 98
Training Facility	N/A	Jun 89	Nov 90	Sep 96
Anniston Depot	Dec 88	Sep 91	Jun 95	Jul 98
Umatilla Depot	Feb 89	Jun 92	Mar 96	Oct 98
Pine Bluff Arsenal	Apr 89	Jun 92	Mar 96	Nov 98
Pueblo Depot	Apr 90	Jun 93	Mar 97	Nov 98
Newport Ammo Plant	Oct 90	Jun 93	Sep 96	Aug 97
Aberdeen Prov Grnd	Jun 90	Jun 93	Sep 96	Sep 97
Lex-Blue Grass	Jan 91	Jun 93	Mar 97	Aug 98

Note: This schedule does not take into account delays due to major failures or litigation and is dependent on funding support

Note: Phase I is the review of the programmatic on-site decision for the individual sites after gathering site-specific data. Once the Phase I reports are completed and certified, the site-specific environmental impact statements are developed.

TABLE 2
CHEMICAL DEMILITARIZATION PROGRAM
TOA ($ MIL)

CHEMICAL AGENTS AND MUNITIONS DESTRUCTION, DEFENSE

	FY 90	FY 91
Budget Activity 1: Research and Development		
Monitor Development	1.0	
Cryofracture Development	6.1	
Toxicology Research	0.8	
Total Research and Development	**7.9**	
Budget Activity 2: Procurement		
Emergency Response	37.9	13.9
Equip Acquisition-CONUS	34.3	197.7
Total Procurement	**72.2**	**211.6**
Budget Activity 3: Operations and Maintenance		
Chem Agent Munitions Disp Syst	22.0	22.5
Johnston Atoll Chemical Agent Disposal System (JACADS)	52.7	55.6
BZ Disposal	18.2	
Program Oversight	0.8	0.8
Stockpile Disposal	28.1	28.6
Program Management	9.6	10.2
Technical Support	1.0	0.8
Emergency Preparedness	14.2	11.4
European Retrograde		2.1
Program Integration	0.2	10.8
Total Operations and Maintenance	**146.8**	**142.8**
Budget Activity 4: European Retrograde		
Steel Containers	1.6	
Other Equipment	0.2	
Site Upgrades and Restoration	0.1	
MILVAN Modifications	0.3	0.1
Depot Support	1.0	
Program Management	3.1	
Container Shipment	0.4	1.0
Ship Modification	1.6	
Technical Escort	0.8	0.2
Island Support	0.1	0.8
Port Handling	0.7	
Security Escort	1.5	
Transportation	14.9	
ACAMS/DAAMS Support	1.0	
Total European Retrograde	**27.3**	*2.1
TOTAL CHEMICAL AGENTS AND MUNITIONS DESTRUCTION, DEFENSE	**254.2**	354.4

***Memo entry -$2.1 included in O&M budget activity**

TABLE 2 (CONT)

	FY 90	FY 91
MILITARY CONSTRUCTION, ARMY		
Tooele Chemical Disposal Facility, Utah		11.8
Anniston Army Depot, Alabama		64.5
Total Military Construction, Army		76.3

Senator **Exon**. Mrs. Livingstone, thank you very much. We have a vote. Senator Thurmond went over and voted, and I will turn it over to you now, Senator. I will be back as soon as I vote.

Senator **Thurmond** [presiding]. Dr. Richardson, as part of the legislation on the fiscal year 1990 DOD bill, which restricts the obligation of funds for the 155 millimeter binary artillery round until the backlog has been eliminated, the GAO is required to provide their assessment as to whether these requirements can be achieved. Their most recent assessment of April 2, states they, and I quote, "believe that it is questionable that contractor can eliminate the production backlog for the three components of the 155mm by October 1, 1990." Do you share this assessment?

Dr. **Richardson**. Sir, I do not. I have watched the contractor who is producing the material for the 155 progress during the last year. The components in question are canisters that contain the binary agents when placed in the 155 projectile. There has been an upward progression in the production rate of the manufacturer. And of course, what we have to certify is that they will work off the backlog by October 1.

As I look at the latest month, for example, on the various canisters that are produced, one of those is the M-20 plastic canister. They are produced at a rate of 105 percent of the amount required to work off that backlog. For the M-20 steel canister, and the plastic canister which goes inside the steel, they are produced at 85 percent. However, they have produced at higher rates in previous months.

On the M-21 canister, they produced at 103 percent of the rate to work off the backlog. I am confident that in the next few months we will see that rate balanced among the different systems, so that we can state that they will work off that backlog.

I also note that the comments of the GAO have changed over the last couple of months. In their April 1 report, they reported it is highly unlikely that the Army can eliminate the backlog by October 1. As you noted in the report that you referenced April 2, they state, "we continue to question whether the backlog can be worked off." I would agree it is open to question, but I see increasing reason for confidence that the contractor will meet the requirement.

Senator **Thurmond**. Dr. Richardson, in your prepared testimony, you mentioned a number of times that the U.S. objective is to negotiate a truly global comprehensive multilateral ban on chemical weapons. Nowhere in your statement do you reference a need for a verifiable total ban on chemical weapons.

Do you think the United States can monitor and verify compliance with a bilateral or multilateral chemical weapons ban?

Dr. **Richardson**. Sir, I think one must take verification and look at its components. One way of looking at that issue is what one is trying to verify. If in such a treaty or convention the parties declare stocks, and it is simply a task to verify that the stocks declared are indeed what they say they are, that is a relatively easy task.

If one looks at verification of destruction. If the parties to the convention or treaty have agreed that they would destroy chemical materiel, it is comparatively easy to watch that destruction to progress.

I also believe large military quantities, militarily significant quantities, can be verified if one combines things that could be provisions of such a treaty, such as challenge inspections, with detection technology, national technical means of intelligence for very large quantities.

It is true that as you get to increasingly toxic agents, increasingly small quantities of material, the task of verification gets more and more difficult. I would invite one of my policy peers for any additional comment they may have in that area.

Senator **Thurmond**. I would be glad to hear from any of the others who care to speak.

Dr. **Richardson**. I think Mrs. Livingstone might discuss a bit the destruction technology verification.

Mrs. **Livingstone**. Senator Thurmond, I just wanted to mention that in terms of the facility for chemical destruction and disposal on Johnston Island that a system has been designed and incorporated in that facility which will verify and record a number of types of factors in terms of the munitions and agents destroyed.

For instance, it will verify and record the type and number of munitions received at the plant for disposal. It will verify and record the number of munitions and items that have been demilitarized; and the number of pounds of agent that has been withdrawn from each projectile or mine or rocket or bulk item that has gone through the facility; and the number of pounds of agents sent into the liquid incinerator it will measure that. Agent type will be measured; agent purity will be measured. There is also a solid waste quantification and qualification system at JACADS.

In addition, there is a system to weigh bulk items that has been designed into the Johnston Island facility as well. And in addition, there is a system which will process the data that is acquired for all of these types of verifications at a very readily retrievable form for either daily or weekly reports as required.

So, in terms of the facility that we have completed at Johnston Island, there are a number of verification instruments in that particular facility.

Dr. **Richardson**. Sir, I think it might be appropriate for me to add, too, that we share your interest and concern about verification. And I think I can say with truth and honesty that all elements of DOD are doing their best to support efforts to start up a verification program. And as I mentioned earlier, we have other agencies involved working in harness, if you would, to work that very important area.

Senator **Thurmond**. Mrs. Livingstone and Dr. Richardson, either one of you can answer this question. The Soviets have recently built a chemical demilitarization plant. Is that plant operational? Will the facility satisfy their destruction requirements under the proposed bilateral and multilateral chemical treaties? If not, are they looking at U.S. companies to help provide the technology and to help meet treaty destruction requirements?

Dr. **Richardson**. Sir, I believe the facility you are talking about in the Soviet Union would be the facility that was installed at Chapayevsk. The facility was set up, and as I recall, it was set up to be a nerve agent disposal facility, with not a terribly high rate of production.

Regardless, however, the Soviets went through quite a bit of concern with the local populace on environmental matters connected with the facility. I know they visited other nations asking for help on things like consideration of environmental impact, environment assessment, and how to handle those kinds of matters. The facility was actually shut down while it was in trial operations last fall. I have heard stories of it being used as a training facility.

There has been clear interest on the part of the Soviets in the commercial arena of using U.S. technology. There are indications, I think, from government-to-government relationships, but I do know for example, of contacts between the Soviet Embassy and potential vendors in this country, completely straightforward contacts conducted properly under notification requirements, looking at U.S. technology.

On our side, we think it is an appropriate, highly desirable thing to do, to aid the Soviets in appropriate ways in destroying their relatively large stockpile. And I would hope that we can come to a means to do that without impact on our own programs to accomplish the same objective on our side.

Mrs. **Livingstone**. Also, Senator Thurmond, the Soviet Union has expressed interest in sending technicians to review our disposal facility on Johnston Island as well as to visit our chemical munitions destruction process at Tooele, Utah. Those visits will be scheduled and exchange of data and briefings to those technicians will be conducted in terms of our technology.

Colonel Walter Busbee, who is here with me today, is the Program Manager for Chemical Demilitarization, and has been participating in some of the exchange of data with the Soviet technicians in Geneva.

Walt, would you care to expand?

Colonel **Busbee**. Senator, I would just add that I have two representatives who will be going to Geneva on Sunday at the request of the U.S. Ambassador, Ambassador Ledogar, who will be discussing technical issues with the Soviets at their request, to set up a technical forum upon which we can exchange data with them in a mutual effort to assist them in their disposal.

In June, we will have the Soviet technicians visit our facility in Utah. And we have extended an invitation to them to visit the disposal facility on Johnston Atoll as well.

Senator **Thurmond**. Is there anything further?

Mr. Chairman, my time is up.

Senator **Exon** [presiding]. Senator Thurmond, thank you very much. I appreciate you filling in. We do have these votes from time to time that require us to leave.

Folks, let me say to all of you that are here that I think this is a tremendously important hearing, and I am going to be asking a series of questions. And we will be moving back and forth amongst Senator Thurmond and myself under the usual time constraints so we can all have a chance to try and get to the bottom of some of the difficulties.

I do not know how many hearings we have had like this on this very subject, but I must tell you that from reviewing what the situation is today, I am not enthusiastic about the chances of continued funding. I have the perception that this program is in disarray for a whole series of reasons.

You will all recall that we, in the last few years, have had two extremely close votes on this particular program. It had been decided at one time, I believe, by the vote of the then Vice President to continue the funding. And then we had another vote where funding was continued by a margin of one vote.

Now it seems to me that we are faced with a whole series of problems and questions not totally unrelated to the fact that we all know about the fencing of funds in the bill last year that came about on the insistence of the House of Representatives and not the U.S. Senate. It would have been impossible to get a bill out without agreeing to those fencing requirements.

From the understanding that I have as of now, we have not met the fencing requirements of that bill with regard to Pine Bluff. If we have, I wish you would correct me, but I suspect that that might be the case.

I will give you a moment to reply to that as soon as I finish because I think that is a very key consideration that I want to know about.

The other thing that I would like to have is, in layman's terms, some understanding of the continued difficulties that we seem to be having with the Bigeye bomb. I do not quite understand with all these modern facilities and with all of the work that we have done on this matter over the years, that we simply have not gotten to where we expected to be last year and the year before that, let alone here, now, in 1990.

I guess I would like some layman's explanation for why it is that in the binary weapons, the system, we seem to have no serious difficulties with the 155 millimeter artillery shell, but are having all kinds of difficulties with the Bigeye bomb. Unravel some of those things for me, if you can, either Dr. Richardson or anyone else that can shed some light on it.

Dr. **Richardson**. Mr. Chairman, I will take that one, and in a moment I will call for help from behind me here. I certainly want to use some of the time that we have available to us to talk to you about those things because I believe the systems are good systems. I think we have had problems in the past and I hope we are on our way out of those, and I believe I have good reason for hope.

Fencing requirements, of course, we had fencing requirements on the 155 that said we had to have canister production out in California up to a rate that would work off the backlog by the end of the fiscal year. As I indicated earlier, I think that will be met, that we will be able to say that.

We have a requirement for the so-called DC production facility at Pine Bluff to be on line, and to have demonstrated the ability to make one of the components, one of the precursor components of the 155 shell. That plant is underway. We are looking at the mechanical completion of the plant in June. We are looking at prove out sometime in July. I think we will be able to meet those requirements at that time.

Bigeye bomb, certainly, I do not think there is any system that has received more traffic, more press on the quality of the system, than this one. I would like to have Larry Pfitzenmaier come up, the program manager for the system, and run you through some of the details of where we are on it and how it looks to us.

Captain **Pfitzenmaier**. Good afternoon, Mr. Chairman. It is a pleasure to be back with you. I visited you last year on the same subject, and as you have noted, I am still here, and I still have things to talk about on Bigeye.

I would like to recall for a moment that the results of our OT-2B testing which occurred last year, although the press in some of the journals that we read painted those as rather bleak, out of 14 criteria which we were tested on, we were only found unsatisfactorily deficient in one. And that particular criteria was reliability. Now, that is mechanical reliability. That has no relationship to safety. We had a number of bombs, which at least for one reason due to redundant safety features, failed to function. No safety impact; they just simply failed to function.

You then directed us as a result of the congressional language to conduct another series of tests which we call OT-2C. These will be extensive tests: 200 bombs that will begin on September 4, in Dugway, Utah. And we are confident that as a result of this testing we will be able to show an increase in the previously demonstrated reliability, which I might add was 79 percent at the 80 percent confidence level. I have seven other weapons systems in my office, and any one of those systems, at this particular phase of development, which is prior to low-rate initial production, would have been permitted to enter low-rate initial production. Those are good numbers, sir.

The facility which is required to manufacture the Bigeye bomb has been built now and is functioning at the Marquardt Company in Van Nuys, California. I believe sir, you have visited the facility and one or two members of your committee have also visited it. We are pretty proud of that facility. It is modern; it is now bending the metal and building the bombs.

We will conclude this next series of tests in January 1991. Following that testing, of course a report will be written. It will take several months for the data to be analyzed. Then according to the terms of the congressional language, we will require certification from two agencies. One is DOT&E, because DOT&E will play a part in the very conduct of the testing and the structure of the test report, DOT&E will, in fact, certify the results assuming we are successful. It is written into the report language itself, the six criteria which must be certified.

The other agency which is required to certify is the General Accounting Office. We are not clear at the moment as to what form and format that certification will take. I, sir, am concerned about the time involved in structuring and processing that type of certification.

Upon conclusion of these certifications, we will be in a position to award a contract for our first production of Bigeye in great quantities in mid-1991.

Senator EXON. Well, given that optimistic report, I would like to reference information that I have received that appeared publicly on March 27 in the Washington Post headlined: "Suppliers Reject Poison Gas Program, U.S. May Have to Act." The substance of this that the critical chemical involved might not be available because the only two manufacturers or sources of supply on this have refused to sell this to the Federal Government and there has been talk that the administration may be taking legal action under some statute to see that they do supply that.

My question is, if this chloride is not available, is it possible to go ahead with all the programs and all the tests and the runs that are described in the fiscal year 1990 authorization bill?

Dr. RICHARDSON. Sir, I am glad you bring that question up, because I welcome the opportunity to lay out what I believe is a more accurate picture on that material.

First, the material is a precursor for one binary component of the 155 system. It is not used in preparation of the chemicals used in the Bigeye bomb. It is used to make DC in the DC plant in Pine Bluff, which in turn is used to make DF, which goes into one of the 155 canisters.

The press that you have seen stems from the government submitting purchase orders to two companies, one foreign owned, one U.S. owned. One of those companies refused the purchase order; the other asked for an exemption to it, exemption to the requirement to fill such an order under the Defense Production Act. There actually is a law, and I am told by Department of Commerce compliance with that is normally required.

But let me cover the options available to us on taking care of this area of business. First, of course, it is not true that those are the only two sources. There are other small sources and a number of other sources for the material. It is widely used in making plastics, in making pesticides and other materials. Material is available in varying quantities or can be made by other manufacturers. So, certainly one option is to look through other possible sources.

Senator EXON. Let me interrupt you right there at this point.

Dr. RICHARDSON. Yes, sir.

Senator EXON. In other words, the thrust of the story is inaccurate; we would not be immobilized just because we could not get the material from one of these two sources, regardless of what action might be legally taken. There are other sources. Is that what you are telling us?

Dr. RICHARDSON. There are other options we can take.

Senator EXON. Now, these other sources, would they be available for supplies in sufficient quantities to make the runs that are required by the fence?

Dr. RICHARDSON. That is under examination right now.

Senator **Exon**. What is your best judgment?

Dr. **Richardson**. Sir, I would not want to prejudge. I know the Army is looking at that. We are also looking at other options. One option is switch to a different material. Thionyl chloride, the material in question, is a chlorinating agent. You can switch to other chlorinating agents. That requires some change in the plant set up at Pine Bluff, and you would rather not do that. That takes time, and it takes money to make those changes.

Another possibility would be to make it in house, in a government facility. Again, it is not a highly desirable option, because it takes money and time.

Senator **Exon**. It would take quite a lot of time to set up a new facility to do that, which would violate the fence, right?

Dr. **Richardson**. That is right. So, the present position we are in is that we are looking at those options. Looking at other sources. We know there are other sources. But as I say, in varying sizes and quantities. I cannot prejudge how that will turn out.

Senator **Exon**. I will come back to this in subsequent questioning. My time is up. Senator Thurmond.

Senator **Thurmond**. Thank you, Mr. Chairman.

Mrs. Livingstone, last year I asked the Principal Deputy Assistant Secretary of the Army for Installations and Logistics, Michael Owen, whether the revised projected date of March 1990 for the operation of verification tests of OTV on the Johnston Island facility would delay the 1997 completion date for the demilitarization program. He answered that it would not.

In your testimony you stated that Johnston Island would go hot in 6 weeks. I assume from your statement that OTV has been delayed yet again. I ask you will this delay force an extension of the congressional requirements to complete demilitarization by 1997?

Mrs. **Livingstone**. Senator Thurmond, the delay in operational verification testing itself does not change the overall schedule completion date for the disposal program; however, there are a number of other factors that have impacted on that schedule, and we will require legislative relief to extend that disposal completion date from April 1997 to December 1998.

The OVT itself is not a causal factor. There have been delays experienced in that. The predominant factor that is extending those schedules is what we call systemization, which is the time that is required, or that we have projected that will be required, to test out, prove out the plant, the procedures and the equipment. Based on our experience on Johnston Island, it has been demonstrated to us that our original projection of 12 months for that process was optimistic, that needs to be extended to about approximately 18 months for the systemization period.

There were a number of other factors that are impinging on the schedule that I would be pleased to go into in more detail if you care to.

Senator **Exon**. Could I interrupt along that line without having it charged against you?

You know, given what you just answered and the question by Senator Thurmond and given some explanation of this, Mrs. Livingstone, on page 7 of your prepared statement you say, that it is not possible to meet the completion of the reduction in these stockpiles until the end of 1998 at the earliest. Given the budget constraints that we have and all the other problems, although I understand we want to get this cleaned up as quickly as possible, is there anything magical about 1998 or could we take longer? Given the constraints of the budget, is that possible or practical, a bad idea or a good idea?

Mrs. LIVINGSTONE. Mr. Chairman, the request for the extension in the disposal date to December 1998 is based on our current best projections for when we feel this program can be completed. There may be other lessons learned that come out as we gain more experience with this program. As you know, we have not begun live agent operations yet at Johnston Island. There may be additional lessons that we gain from that experience that could impact on the schedule. Hopefully, over time, the lessons learned process, as you will, will actually help us shorten the schedules at the follow-on plants. But right now, what we are doing is gaining experience in the process as we actually develop a facility and approach going into an operational status.

So to answer your question directly, there is nothing magical about the requested extension until December 1998. That is our current best guess of a projection of when we feel we can have the disposal program completed. There could be other impacts that we do not know of at this time that could further extend that program. We hope there will not be.

Senator EXON. So the short answer to the question is, yes, we could go beyond 1998.

Mrs. LIVINGSTONE. Yes, sir.

Senator EXON. Thank you, Senator Thurmond.

Senator THURMOND. You are welcome.

Senator EXON. I am sorry to interrupt, but I thought it was on point.

Senator THURMOND. Dr. Richardson, in compliance with section 172 of the fiscal year 1990 National Defense Authorization Act, Secretary Cheney certified that, and I quote, "An adequate United States binary chemical munitions stockpile will exist before the withdrawal of existing stockpile from its present location in Europe is carried out." Can you provide this committee with the basis upon which Secretary Cheney made this certification to Congress?

Dr. RICHARDSON. Yes, sir. I will have Maj. Gen. John Sewall of JCS respond to that question for you, because, of course, he represents the operator who uses the systems in question, and I think it would be appropriate for him to have a chance to answer your question.

General SEWALL. Senator Thurmond, the basis for the JCS input to Secretary Cheney basically goes along the following lines. And I would stress at the outset a framework and that basically parallels some of the comments that the chairman already mentioned. That is a very drastic reduction in the threat picture that we see, and specifically, of course, the threat picture in Europe, which we all read about in the newspapers, the Soviet and, of course, the Warsaw Pact, which is in effect almost a paper name alone but not a credible threat in terms of chemical munitions.

Also, as you are well aware, another part of the framework on which we made our analysis was the fact that the principal adversary, the Soviet Union, we are about to enter into hopefully a bilateral agreement, which would entail a significant reduction.

So, our analysis was focused on Europe only, not worldwide requirements, if you will. And basically we looked at the analysis about the December time frame and when we provided the Secretary of Defense our input in January, it was based on our estimated stockpile of binary 155 rounds to be delivered at that time and then any other deliveries thenceforth.

Our judgment on a European analysis only, considering the threat, considering the potential for arms control was that sufficiency was achieved by the stockpile, the inventory of 155 binary rounds and any subsequent delivery of those rounds.

Thank you, Senator.

Senator THURMOND. Thank you, General.

Mrs. Livingstone, the additional delay in the OTV of Johnston Island points to the concern of some members regarding our reliance on JACADS for the destruction of your unitary chemical stockpile. As you know, Congress required DOD to spend prior year money on the alternative destruction process called cryofracture.

What is the status of the cryofracture program? How much of the funds have been obligated? Is the Department going to ask for additional funds to continue the program?

Mrs. LIVINGSTONE. Senator Thurmond, this past January, a letter contract was awarded to General Atomics to reinitiate research and development work on the cryofracture process. The contract itself should be definitized by the end of this month so that we will have a formal contractual relationship with them.

As you may recall, the fiscal year 1989 plus the fiscal year 1990 monies that were made available for this research and development effort were $22.4 million. Part of that money will be going into the additional testing of the cryofracture process, and part of that money will be going into process design of the cryofracture system and also it will be going into the environmental documentation that would be required for that system.

At the current time, we are negotiating the specific requirements with General Atomics and also with Mitre for an independent overview or oversight of our cryofracture testing program.

Should additional funds be required to meet the additional negotiated items that may come out of this process, I will notify Congress. Currently, however, we are within the $22.4 million that Congress has provided for the cryofracture R&D.

Senator THURMOND. I believe my time is up, Mr. Chairman.

Senator EXON. Thank you, Senator Thurmond.

Let us go back, if we might now, to this time delay. Let me ask you first, Mrs. Livingstone, the contracts that you just alluded to in answer to questions by Senator Thurmond, do I correctly assume that those contracts will use monies not covered by the fence?

Mrs. LIVINGSTONE. The cryofracture contract, sir?

Senator EXON. The contract you just referred to.

Mrs. LIVINGSTONE. There is not a fence on those particular funds. It was identified to Army that the expectation was that $16.3 million in fiscal year 1989 funds, plus $6.1 million in fiscal year 1991 funds would be utilized for the cryofracture testing process.

Senator EXON. The reason I ask the question, let us be very, very careful and make sure we do not expend any funds for whatever purpose if they were included in the fence. I am just giving that advice to you.

Let us go back to this matter of time delays on the critical material. From what I have read and from the testimony that I have been given here, there are two or three ways around this.

Number one, we could bring a lawsuit and hopefully get relief through the courts so that the two suppliers, the known, identified suppliers are forced to supply the material whether they want to or not. I assume if you go into court that is a very time-consuming problem, and I cannot imagine that would be handled very expeditiously.

The second answer was that this is available from other sources, although not readily available, and if we decide to go that route, I anticipate that it would take some time and difficulties in delay.

The third option was that maybe we could make this ourselves.

It seems to me that all of those three, or a combination of the three, would signal delays of months or years, would it not?

Dr. RICHARDSON. Sir, I hope not. It unquestionably is an item of concern and one of great interest because we want to proceed. We feel we need these systems to provide the most effective deterrent.

Just to be fully aware of the possibilities, there was a fourth option, and that is modify the plant to use a different chlorinating agent, and that is one of the possibilities. That, too, is somewhat time consuming but certainly better than starting a new plant and building from there.

Certainly the option looked at that is most attractive and is underway, is looking at other sources. And I know that is active; I have heard things on that as recently as yesterday afternoon. I have heard of sources that have material in stock. Those need to be checked out, and in some cases in this area, you have brokers who do not manufacture it, but buy it and sell it. We have some interest in that case in where they buy it, so it is certainly an item that has our attention.

At the moment I cannot project what amount of time might be involved in that.

Senator EXON. I understand the position that you are in, Dr. Richardson. I want you to understand the position the committee is in on this whole proposition. You know, wherever you get it, and from whatever source, the time delay is the essential element here for funding of this program, especially getting Defense to move from the fences in the 1989 budget.

What I am getting at is that, given the delays that we are obviously now facing that we did not anticipate a year ago, when this fence was put into effect, is there a necessity for any additional funds for these programs in the 1991 budget?

Dr. RICHARDSON. Sir, all I can say at this time is we are working it. I am hopeful that the delay is not much. As I say, I have heard of one source this week that said I have it. They are checking out the purity of the material, source of the material, that sort of thing.

I would add, I have Mr. Bill Dee, Deputy Program Manager of binary here.

Bill, do you have anything to add that might help define any time period?

Mr. **Dee**. Senator.

Senator **Exon**. Mr. Dee, please help us if you can.

Mr. **Dee**. Sir, there are a number of brokers who have indicated that they can supply material. Again, as Dr. Richardson said, it is quite critical where this is from and, properly, where it is made at.

We also are looking into, as indicated, alternate sources of material. Unusually enough, it is a material that is used for any number of different uses. It has quite a number of different uses and quite a number of other materials could be used for the same thing.

I have had a study underway to look at the alternate sources, to price out what that would cost to do it and to also schedule out what times it would take to go to other sources of materials. That is not complete as yet, but I expect it to be in the future.

Senator **Exon**. Well, with your experience and background in all of this, assuming things would work out optimistically, you must have some thoughts in mind. Assuming that your study would be optimistic, what would be your assessment at this time? Are we talking weeks, months or years in delay?

Mr. **Dee**. If the sources pan out that have offered up material, there will be no significant delay. We will have the material at the same time—that we would be able to start the facility. If we have to go to alternate sources, by alternate sources, alternate materials, I would see at least a 6-month delay.

Senator **Exon**. So what you are telling us then that the most expeditious manner that you would hope for is to find other suppliers in sufficient quantities to meet the run schedules and to unfence the 1990 funds. That is the best way to go to meet the time-sensitive problem.

Mr. **Dee**. Yes, sir, that clearly is.

Senator **Exon**. Are we talking about a significant delay? In other words, would it then be weeks as opposed to months or years?

Mr. **Dee**. No, that would be weeks as opposed to months, yes, sir. Actually, the facility right now would be mechanically complete as Dr. Richardson said in June, and we should start the prove-out and run that through July. That is the very latest assessment. That has changed slightly. We should be able to meet that if that is the case.

Senator **Exon**. Well, thank you. Let us turn back to this matter of the stockpile which we were talking about during my last round of questioning. What is the destruction timetable in the United States? What is the United States proposing for the bilateral reduction agreement with the Soviets that may be signed at the June Summit?

Dr. Richardson. Sir, I would like to offer one of my compatriots here, Lisa Bronson, the chance to address that because she has watched those activities and participated in activities and she can lay that out, I think, in a more concise manner than I might.

Ms. **Bronson**. Thank you. At this time we have not put in specific dates or time schedules in the bilateral destruction agreement. It is envisioned that we would put those dates and times and schedules in at the last moment possible so that they would be complementary to the rest of our chemical weapons program schedules.

Senator **Exon**. Let me try and assume something else to get a little better hold on this timetable. Assuming that the treaty was signed, say, became operative 2 years from now. If that would happen, I guess that we would have until at least some time after the turn of the century, maybe the year 2002, before we would have to destroy our stockpile. Would you agree with that time frame?

Ms. **Bronson**. Senator, I think that that time frame is a little long for the beginning of the destruction schedule. One thing that I——

Senator **Exon**. I do not mean the beginning.

Ms. **Bronson**. You mean the completion? I think that that is a fair ballpark figure. One thing I would like to mention, and that is the context in which any schedule with the Soviets would be arrived at. It is not unimportant to remember that they are easily 2 to 3 years behind us in their ability to destroy chemical weapons, and that their destruction program will most likely be done with our assistance.

That bilateral destruction agreement has a second part to it. It has a program that will be established for cooperative sharing of technology information and destruction techniques. So they are not going to commit to a schedule that they cannot meet, and the schedules will be compatible.

Senator **Exon**. Well, that got into the heart of the next question that I was going to ask you. Let me follow that up a little further.

It is true, then, that the Soviet Government has been having considerable difficulties with their facilities. As I understand it, it is so bad that they have even been challenged by some of the Soviet environmental groups. Is that true?

Ms. **Bronson**. It is difficult to be able to confirm that. What we do know is that the facility that they had built is not operational and has currently been designated to be only a training facility. So, at this time they do not have an operational destruction facility, and we have no indication that they have the technology to achieve one by themselves in the future.

Senator **Exon**. Then, is it fair to assume that with all of the difficulties that we and the Soviets are having in this area, and probably more difficult on the Soviet side than ours, that it is likely the Soviets would not object if we proposed a longer timetable for the bilateral agreement on destruction, say, one that would extend beyond the 1998 figure that we have alluded to here this afternoon?

Ms. **Bronson**. It is difficult to see that far in the future but that is not an unreasonable starting assumption.

Senator **Exon**. My time is up. Senator Thurmond.

Senator **Thurmond**. Thank you, Mr. Chairman.

Dr. Richardson, would you please describe the military benefits and requirements for both the 155mm binary munition and the Bigeye chemical bomb? And then why is a nonpersistent and persistent agent required by the commanders in chief?

Dr. **Richardson**. Sir, that is a perceptive question and one that I think warrants some discussion. I find that in the chemical community those people who work with how to cope with the threat every day tend to take some things as intuitive that are not clear to people who are not that involved.

The 155 binary would, if used, produce a nonpersistent agent. The Bigeye bomb would produce a persistent agent, if employed, and I think I should mention, of course, much of the threat that we worry about being against our forces consists of both components, persistent and nonpersistent agents. But what I find often is that people do not have a perception of the difference between those two and, indeed, why Bigeye is such an important component of the deterrent posture we strive for.

Nonpersistent, I think to most listeners, means that the material is around for a short time, minutes in many environments. I do not think it conveys to the average listener the fact that for nonpersistent agents such as GB, used in the 155 binary, it requires only a mask for protection. It does not require the full ensemble, the full protective clothes, boots, garments, that sort of thing and nonpersistent does not require decontamination as is required with a persistent agent.

I believe typically that in using nonpersistent agents it was used in the Iraq-Iran conflict, it is used near one's own forces so that it does dissipate and you can travel through the area.

On the other hand, a persistent agent requires full ensemble protection. The gloves, the boots, the heavy garments, the heatload that goes with those materials, the lack of dexterity that one gets through wearing protective equipment, decontamination so that one is essentially faced with the mops and brushes and decontaminating solution aspects of cleaning up.

And the great concern one must face in that area is that much of what is sometimes called the Third World is developing, or has developed, persistent agents and the capability to deliver those agents at long distances. That necessarily means that if you had a binary posture that does not include something like the Bigeye bomb, an adversary could perceive an advantage. You have a short-range system, the 155 binary artillery projectile; he has a long delivery range of a persistent system, which forces you into a protective posture.

I have seen studies of performance decrement of all types of crews wearing those protective systems for about 20 years. I think in every case I have seen a decrement that ranges from 30 to 50 percent compared to normal. There are some operations that get extremely difficult to do in that condition.

I think, Senator Thurmond, that is the approach I would take in answering that question.

Senator **Thurmond**. Dr. Richardson, in your prepared testimony, you stated that, and I quote, "We are currently studying various binary modernization options for the future." What kind of options are you examining? What new requirements, if any, does the Department envision in the future?

Dr. **Richardson**. Sir, I think there are two things in that statement. First, it is simply prudence to look at the path of international negotiations, look at the President's proposals at the United Nations, look at the President's speech at Malta and look at what course we might take that would meet that national policy.

And with that, of course, the options are wind-down in total stockpile and, even before the President's initiatives, we have stated in these chambers and elsewhere that the stockpile we would have looked for in binary would be only a fraction of what we have had in the unitary stockpile. The President, of course, has said that upon entry in the force of a multilateral treaty we would cease production. It is also published information that we would look toward a wind-down of stocks that we have upon entry in the force of a treaty, and, indeed, in advance of that with suitable agreement with other parties.

So we look at those options. We look at options of what kind of mix would we want to have in a small stockpile. As far as additional systems or new systems, I can truly say there is not very much significant going on in that area. In the 6.2 or exploratory development area, we keep people thinking about such a thing, but it is perhaps a man-year and a half or something of that sort.

Senator THURMOND. My time is up.

Senator EXON. Thank you, Senator Thurmond.

Back to the Bigeye again, Dr. Richardson? If I remember correctly the testing was planned to begin in May of this year. I believe the testimony today has indicated that it is now up to September. Is that correct?

Dr. RICHARDSON. That is correct, sir.

Senator EXON. How confident are you at this time that the testing indeed will start next fall, given the problems that we have discussed at great length here today.

Captain PFITZENMAIER. Mr. Chairman, that is correct. The testing has slipped 3 months. The primary reason, in our view, is the contractor's ability to lay in the vendor items and the subassemblies that he is required to have on hand to build the bomb. This has taken him longer than either he or we anticipated. Those parts are now coming in house in Van Nuys, California at the Marquardt facility.

And we feel that buying these 3 months time will be sufficient for us to arrive at a position where we have completed first article acceptance testing by July 27, and at the same time, we will take delivery of our first lot of 100 bombs.

We have also modified the contract to include a liquidated damages clause, where the contractor is required to forfeit $3,250 per day for a period of 45 days any day beyond July 27, should he fail to deliver.

Senator EXON. Again, I think we are all disappointed to hear slip, slip, slip—this program has been slip, slip, slipping for years now. And there may be some understandable and explainable reasons for it, but we have heard this story on many occasions.

When will the testing program, if it goes forward as you have now envisioned it will go forward, when will that testing program be completed? Will it take place over a 6 months period, longer or shorter? How do you propose to compress this program if that, indeed, is in your plan?

Captain PFITZENMAIER. We feel, sir, that we will be able to complete the testing program by mid-January 1991. The unknown factor in that is the weather at Dugway, Utah, the critical factor, primarily, being wind. If we have predictable weather, the type of weather which is normally expected at the test site, from September through January, our test planning, the sorties that are required and the schedule we have planned for the delivery of the weapons will conclude the testing in January 1991.

Senator EXON. Once the test is completed, how long do you estimate it will take for the director of the test and evaluation and GAO to submit their reports to the Congress?

Captain PFITZENMAIER. We have a commitment of no longer than 90 days for the test community to assess the data, evaluate the test data, prepare and submit their report. The certification required by DOT&E will be forthcoming in very short order. There may be, in fact, a way to format the test reports so that in itself it provides the DOT&E certification.

The means by which we will attain GAO certification, the timeliness, their willingness to submit to a reasonable timetable, sir, of these I am unclear and uncertain. I do not know the format which will be required for GAO to perform that function.

Senator EXON. Well, it seems to me, folks, that with the slip in this program, even the optimistic assessment of the completion of the program testing and then the report to Congress probably is not going to be much before this time next year or thereabouts. Recognizing the 1988 congressional prohibition cannot be lifted until they are, indeed, submitted, why are you requesting $66.7 million in procurement funding for 1991? Do we not have the cart ahead of the horse here, a little bit?

Captain PFITZENMAIER. If we are able, by May or June, to complete the certification requirements, we would then be positioned and ready to award a contract at that time for the first increment of bombs. Now, of course, we would have liked to do that earlier in the year than May or June.

Senator EXON. But you are not going to be able to?

Captain PFITZENMAIER. We are going to be able to do it in the 1991 time frame and we feel we are going to be able to do it in advance of the end of that time frame, where it would be more appropriate to push this into 1992.

There are obviously, sir, uncertainties, as I have mentioned in the test sequence, the weather, and clearly, the reason you do tests is to confirm what you believe. If we run into test difficulties, that also would translate into a schedule delay. We do not feel we will find test difficulties.

I would like to add something that I failed to add in my last group of comments. We are not simply hoping for the best on this. We have taken specific steps in four areas of hardware, four components of the Bigeye bomb, to ensure increased reliability. We had difficulty in these areas in our previous testing. We have done some small, minor redesigns of these components. We have verified the documentation packages. We have improved our ability to produce these components. And in one case, the case of the FMU 140 fuse, an integral component of the Bigeye bomb, we have recently completed a test series of 68 weapons—actual weapon releases, where there were 65 successes, two no-tests and only one questionable drop from an engineering standpoint, and we understand what that problem was.

So, based on our technical assessments, sir, we feel that the tests have every probability to be successful.

Senator **Exon**. Well, given the controversy that has surrounded this program for so long, the number of close votes on the floor of the U.S. Senate that I referenced earlier, and given what we have heard here today on the further delays that you have frankly told us about, would it not be more prudent simply to wait until next year to decide on production funding when, by then, you would expect to have all of the information before us that we need to make this decision?

Captain **Pfitzenmaier**. I believe Dr. Richardson may be able to add to this.

One difficulty, Senator, with waiting if, in fact, we are able to begin before 1992 is that it extends the time period at the Marquardt Company where they would be in a shutdown status with no Bigeye-type of work going on, they would be forced to lay people off and then rehire and all of those same problems that are associated with any production line going cold. Those are not insurmountable, but they may be avoidable.

Senator **Exon**. Well, assuming that the tests and the report back and all these things go exactly as planned—that would be true. But supposing these tests and all this do not go through, then they would be faced with the identical situation that you outlined in answer to my question. Is that not true?

Captain **Pfitzenmaier**. That is correct.

Senator **Exon**. My time is up, I have one more series of a few questions I would like to ask in my next round.

Senator Thurmond, it is your turn.

Senator **Thurmond**. Thank you, Mr. Chairman.

Dr. Richardson, I believe you stated in your prepared testimony that good progress is being made in our recently established treaty of verification research and development programs. How much money has been obligated to contractors for monitoring technology and what kind of technology shows promise for helping the United States monitor compliance with a chemical ban?

In addition, why was there no request for additional funds this year? How do you intend to do technical compliance monitoring if no programs or technology exist?

Dr. **Richardson**. Sir, if I understand the last part of the question, let me answer that one first. The amount placed in the budget by Congress for fiscal year 1990 is $15 million. The language described that as for use only by OSD and that was actually placed in an Army line. We have taken action to have that money moved and managed by the Defense Nuclear Agency to serve as an executive agent in an oversight, management, accounting, tracking, role that sort of thing.

In the 1991 budget, we have $22 million for continued DNA oversight and parceling out of particular activities in that area. So, first, we do have money in the planned 1991 program.

I would also say one of the things that I mentioned earlier, that I thought was encouraging in progress in this area, is the interagency involvement. Besides the DOD budget we just talked about, we see DOE working on the technology base with plans on technology base that is promising to transition off to DOD development programs that would come on downstream. And the last information I had from DOE says that they've got about $4.7 million programmed in this area.

With other agencies that play a key role in this, like the Arms Control and Disarmament Agency or ACDA, I had discussions just yesterday furthering our plan to give them some money to get them started this year, but they have plans in their own budget and they are looking at doing some organizational things to play a more active role in the treaty business in the sense of national trial inspections, practice inspections on how you do this and the interagency coordination thing. And the last I heard they had something in the realm of $3.1 million planned for next year's budget.

On the money obligated, I wish I could say that we had contracts with funds obligated in progress and that sort of thing. I think there are small efforts that were ongoing. Where that is the case on the $15 million, we, of course, were required to develop a plan, send it to Congress, wait 30 days for comment. We did achieve that, with the plan being sent over in January. But we also did that at a time of great flux in the path of what kind of convention one might be aiming at as to how, say, inspections might be handled, whether they are handled by national teams or an international inspectorate; so that took some time. The interagency thing as I mentioned has taken some time.

Where we are now on money is we have taken action for the money to be put at the Defense Nuclear Agency on the DOD, $15 million this year, and I am hopeful that in a very short time that will be parceled out to other government agencies and to contractors to proceed.

Senator THURMOND. Thank you. Did you answer what kind of technology shows promise?

Dr. RICHARDSON. I am sorry. I should address that.

Senator THURMOND. Please go ahead.

Dr. RICHARDSON. What we see in the area—first, the approach. We feel that we need to make a fair portion of the investment on near-term things using existing technology. Outyear, we hope to be able to phase over, maybe late in the second year, certainly by the third year, to working higher technology things that show promise for new capabilities.

The first year program has considerable activity in it for taking available equipment, protective equipment, detectors, that sort of thing, examining those, how they could be fit together in a system and how you play those in the treaty verification arena.

There are considerations in that of international release of technology. One of the things that has been interesting in recent months is to look at the on-site inspection agencies experienced with the INF Treaty. One sometimes finds that devices that do more than they have to do for purposes of that treaty or that imply very high technology, can be a problem just in use.

So the general approach is near term: take essentially off-the-shelf items and be ready for the possibility of a come-as-you-are sort of implementation of the treaty. The phase could include other items, such as one in which I know a member of this subcommittee is interested, Senator Cohen, which we refer to as the biochemical detector, which could be useful in allegations of use of chemical weapons and protection of a team.

Now that area within the Army budget has been given increased funding in the 1991 period, that is about a $25 million effort by itself.

Senator THURMOND. I think my time is up, Mr. Chairman.

Senator EXON. Senator Thurmond, thank you again.

I just have one more item that I want to get into that requires answers to three or four questions, Dr. Richardson, and then I'll be glad to recognize Senator Thurmond again, and then maybe we can submit additional questions for the record that we would appreciate your prompt answer to, as is customary.

The Air Force Collective Shelter issues, in your statement, on page 13, you say that the Air Force has installed 121 survivable collective protection shelters and is planning to procure another 43. This number is dramatically lower than the 1,700 units the Air Force originally planned to deploy worldwide and well below the level of procurement recommended by the Congress just last year.

In your statement, also on page 13, you say there is a reduction due to the change in the situation in Europe, including prospective air base closings. You also say the Air Force will rely more on transportable collective shelters.

Will you provide the committee with the recently completed, I think you say, review, which if I understand it correctly, has established the revised requirements for the fixed SCPS units in Europe. Can you supply that for the record, or would you care to comment on that now?

Dr. RICHARDSON. Sir, if we can take just a moment, I will have Gen. Dick Hawley who has been watching that item particularly give you a few comments on that now, and then if you need more, we will provide it for the record.

General HAWLEY. Yes, sir, Senator Exon. CINCEUSAFE has completed his review of the requirement, and he has determined that he requires another 33 beyond the 121 which we have already set out installing in the central region. He feels that he needs another 22 in the United Kingdom, and 11 in Turkey to complete his requirement for the fixed survivable shelters.

Senator EXON. I would ask this of any of you who could answer, do you believe that the nature of the threat in the Pacific has changed to such an extent that we can get by with only installing a handful more of fixed shelters in Japan and Korea?

General HAWLEY. Yes, sir. The CINCPACAF has also completed his evaluation of his requirement for the fixed shelters. He has adjusted that requirement to just the 10 that you cite in Korea, and he is satisfied that he can meet his requirements through individual protective equipment and the transportable shelters which we are procuring in conjunction with the fixed shelters.

Senator EXON. In response to a February 1987 GAO report, the Air Force stated that, and I quote, "If you use the SCPS and transportable collective protection system that is complementary, not mutually exclusive systems." Do you consider them then interchangeable?

General HAWLEY. No, sir, I think that statement remains true, but as has been pointed out here a number of times, the changing nature of the threat, the uncertainty concerning the number of forces that we will have deployed overseas, and the increasing emphasis on the need to be flexible and respond to deployment requirements worldwide shifts the balance between those two systems, and that accounts for the lesser emphasis on the fixed systems, with an increasing emphasis on the transportable systems.

Senator EXON. General, it's my understanding that the fixed SCPS are made of steel-reinforced concrete modules and designed to provide protection against conventional bomb blasts as well as from chemical attack. Is that a correct understanding?

General HAWLEY. Yes, sir, it is. Those are concrete and steel shelters which are buried in the ground or at least the tops of them are about at ground level and are earth-covered so they do provide some protection from blasts and fragmentation as a by-product of the chemical protection.

Senator EXON. Well then as a follow-up question, do the transportable shelters offer any protection against such blast effects?

General HAWLEY. No, sir, they do not provide any protection against blasts and frag.

Senator EXON. Thank you. That is all the questions I have at this time. I have said there will be additional ones for the record.

Do you have further questions, Senator?

Senator THURMOND. I have about four more.

Senator EXON. Please continue.

Senator THURMOND. Mrs. Livingstone, the new environmental impact statements have not been completed for all of the proposed chemical destruction facilities. Do you foresee any potential environmental impact problems at the other sites scheduled to have chemical destruction which could further delay the completion of the destruction program beyond 1998?

Mrs. LIVINGSTONE. Senator Thurmond, at this time, we do not anticipate that there will be difficulties in that arena. As you know, we conducted a programmatic environmental impact statement for the entire chemical disposal program that is then followed by what we call a Phase 1 review at each site, in which we go back and revisit the decision to destroy those munitions on each one of the eight U.S. storage sites.

If our Phase 1 review, which is, again, independently overseen by an outside contractor, confirms that on-site destruction is still appropriate, then we move forward into a site-specific environmental statement. At this time we are not anticipating difficulties in that regard.

The one major schedule problem that we have had in the environmental arena has been with the Resource Conservation and Recovery Act permits, RCRA permits. The new requirements and the elongation in obtaining those permits are reflected in the revised schedules that we have provided to you already.

Senator THURMOND. Mrs. Livingstone, other than in your prepared testimony regarding your impressions of the National Academy of Sciences/National Research Council oversight of the JACADS facility, did you have anything further to add?

Mrs. LIVINGSTONE. No, sir. The National Academy of Sciences/National Research Council, in my view, has been a very helpful outside independent review body for this program. I think it's always good to have other minds and other perspectives brought in on a program of this nature. They have been out to Johnston Island; they have had some good ideas; and they've been very helpful in my perspective. As a matter of fact, we are currently proposing a renewal of our contract with the National Research Council for an additional year of oversight.

Senator THURMOND. Mrs. Livingstone, do you have any comments on the recently passed Senate version of the Clean Air Act and the effect it will have on the Chemical Demilitarization Program?

Mrs. LIVINGSTONE. Senator Thurmond, I have not had the opportunity to analyze the specific changes there. I may ask if Col. Walt Busbee has had an opportunity to do so.

Colonel BUSBEE. Senator I would add that we have not seen the full act as it is, but we are looking at compliance at each of these facilities, which are the most stringent standards we think that would be attainable, and we believe these facilities can meet the existing standards, as well as any new standards that would be imposed. That is certainly our goal and objective. These are very good state-of-the-art facilities that do not discharge any detectable levels of chemical agents and comply with the very stringent population protection standards that are necessary for a safe disposal program.

Senator THURMOND. Dr. Richardson, since the agent for the Bigeye bomb will be produced at Pine Bluff, I am interested in knowing whether a delay in the prove-out of the Pine Bluff facility for the 155mm chemical agent will have an impact on Bigeye. In other words, are there different agents produced at separate unrelated facilities at Pine Bluff?

Dr. RICHARDSON. That is correct. At Pine Bluff, the plant facilities that you are talking about are separate facilities. There is an enclosed facility at Pine Bluff for Bigeye. I toured that facility last week, an impressive mechanized facility. The chemical facilities that you are talking about, there is a DC plant that applies to 155, would also apply downstream to the multiple-launch rocket system. And you are looking at the QL facility for the Bigeye bomb.

Senator THURMOND. Mr. Chairman, I have completed my questions. I thank the witnesses for their appearance here.

Dr. RICHARDSON. Thank you for having us, sir.

Senator EXON. Thank you, Senator Thurmond. Just let me add my thanks to you, Dr. Richardson, and you, Mrs. Livingstone, and those who accompanied you here today for being very frank in your answers to our questions. You have been helpful.

Thank you very much and with that we adjourn.

[Questions for the record with answers supplied follow:]

QUESTIONS SUBMITTED BY SENATOR SAM NUNN

AIR FORCE COLLECTIVE SHELTER ISSUE

Senator NUNN. In your statement (p. 13), you note that the Air Force has installed 121 Survivable Collective Protection Shelter (SCPS) and is planning to procure only another 43 units—a total of 164 rather than the 1,700 originally planned.

How many Main Operating Bases and Colocated Operating Bases (COBs) do you expect the Air Force to maintain in Europe in a post CFE environment?

Dr. RICHARDSON. The Air Force does not know yet how aircraft will be affected by the CFE treaty. Until the treaty is signed, the future status of base drawdowns is unknown. The Air Force expects reductions in both Main Operating Bases (MOBs) and COBs in the future.

Senator NUNN. Roughly how many essential military personnel would be at those bases in a crisis, including augmentation and reinforcement personnel?

Dr. RICHARDSON. Because of the uncertainty regarding the number of bases that will remain, it is impossible to provide even a rough estimate of the total number at this time. We can say that a typical MOB would have between 1,800 and 2,200 essential (direct sortie generation) personnel. This number is affected by mission, type of aircraft, maintenance requirements, and location. A typical COB with one tactical fighter squadron and associated supporting units would have roughly 700 to 800 essential personnel. Again, this number is affected by the same factors as described above.

Senator NUNN. What percentage of this total could be offered protection from chemical attack in SCPS's assuming only 154 SCPS units are installed throughout Europe?

Dr. RICHARDSON. Again, it is impossible to provide even a rough estimate at this time because of the uncertainty as to the number of bases the Air Force will maintain in the post-CFE environment. We do know that for those Main Operating Bases which now have or will receive SCPS, the available SCPS will protect 100 percent of the essential personnel at each of those bases.

Senator NUNN. The Air Force had originally planned to install 568 SCPS at COBs in Europe. How many SCPS do you now plan to install at COBs?

Dr. RICHARDSON. The Air Force no longer plans to install any SCPS at COBs. The original plans for outyear-funded SCPS at COBs were tentative and not yet part of any formal agreement with the host countries. Because of the changing situation in Europe, the Air Force has decided it is not prudent to continue planning for the installation of SPCS at COBs.

Senator NUNN. Secretary Cheney has announced the closing of Zweibrucken Air Base in Germany. Can the 9 SCPS installed at that location be relocated?

Dr. RICHARDSON. The Air Force indicates the SCPS at Zweibrucken could be relocated, but it would be cost prohibitive to move them to the United Kingdom or Turkey, where additional SCPS are desired.

Senator NUNN. How much in prior year funds is available at USAFE and PACAF to procure additional SCPS? Please provide a year-by-year breakdown of these funds.

Dr. RICHARDSON. USAFE has $22.0 million in fiscal year 1988 funds to procure additional SCPS for bases in the United Kingdom and $10.0 million in fiscal year 1989 funds to procure SCPS for a base in Turkey. PACAF has $10.0 million in fiscal year 1988 funds to procure SCPS for a base in Korea.

CHEMICAL WARFARE ANTIDOTE AUTO-INJECTOR

Senator NUNN. In fiscal year 1989, Under Secretary Costello approved the recommendation of the Defense Logistics Agency (DLA) to establish a "service contract" arrangement with Survival Technology, Inc. (STI), the principal U.S. supplier of chemical warfare antidote auto-injectors, rather than rely on sporadic Stock Fund requisitions from the services. In fiscal year 1990, this decision was reversed by the Deputy Under Secretary for Industrial and International Programs. In fiscal year 1991, it is uncertain whether DLA orders for this item will be sufficient to persuade STI to remain in this business. Was the OSD decision to reverse the earlier decision to establish a "service contract" approach coordinated with your office?

Senator NUNN. Did you concur with this decision?

Dr. RICHARDSON. The decision to change the approach for dealing with the auto-injector production base problem was made by the appropriate OSD office responsible for industrial base issues. The decision was made after duly consulting with service representatives responsible for, and knowledgeable of, this issue.

Senator NUNN. Do you believe that the DLA stock fund requisitions for this item in fiscal year 1991 will be sufficient to maintain two firms competing in this area?

Dr. RICHARDSON. The DOD is undergoing a thorough reexamination of the nature of the threat and the force structure required to deal with that threat. There should be little doubt that the wartime requirements previously projected for material in a European theater will be less as a result of the changing situation in Europe. The DOD already possesses a substantial stockpile of the auto-injectors projected against previous wartime requirements of these items in light of the changing European situation. We can't commit to the level of funding for fiscal year 1991 that will be available for this item at this time.

Senator NUNN. What would be the implications for our chemical defense program if STI dropped out of the business and a foreign-owned firm became the only supplier to the U.S. Government?

Dr. RICHARDSON. The risk to the U.S. national security would not be appreciably increased if STI ceased business operations. The remaining competitor is a European headquartered firm with domestic operations that use domestic subcontractors to provide components for the finished product. Further, the European firm provides most of the nerve gas antidote to the personnel of our allies' military forces. The U.S. Army has been testing a new mechanism to provide nerve gas antidote that looks promising and may supersede the existing treatment system within the next 2 to 3 years. From an acquisition perspective, we would prefer to see competing firms capable of meeting our needs; however, we recognize it is not always feasible.

GREENPEACE

Senator NUNN. The Greenpeace organization maintains that the accumulation of scientific knowledge since 1983 concerning the environmental hazards of burning, or incinerating, toxic wastes has made the 1983 Environmental Impact Statement (EIS) on the Johnston Atoll Chemical Agent Disposal System (JACADS) obsolete. How would you respond?

Mrs. LIVINGSTONE. The 1983 environmental impact statement completed for the Johnston Atoll Chemical Agent Disposal System (JACADS) is not obsolete. The information included in that document is valid and has been updated by two subsequent supplemental environmental impact statements. The scientific knowledge mentioned by Greenpeace concerns the incineration of hazardous wastes, not lethal chemical agents. Since 1983, the Army is the only agency that has done tests on chemical agent destruction and the information it has gained is incorporated in the second supplemental EIS done for JACADS. The National Environmental Policy Act allows for the updating of EISs by supplemental documents.

Incineration is still the best technology available for destroying these materials and will be further validated once JACADS starts destroying chemical munitions on Johnston Island.

Senator NUNN. Greenpeace recommends that we put the entire JACADS approach on hold and instead explore other R&D avenues for neutralizing or demilitarizing the chemical weapons without having to burn them. To what extent has the Army already looked into such alternatives?

Mrs. LIVINGSTONE. First of all, to place the complete disposal program on hold while waiting for a better technology to come along may be hazardous, since the programmatic environmental impact statement for the Chemical Stockpile Disposal Program concluded that the most risky alternative was continued storage. The chemical stockpile is over 21 years old and deteriorating with age. The number of leakers is increasing; we have concerns about rocket propellant stability and maintenance is becoming more difficult. Costs to secure and maintain the unitary chemical stockpile are estimated at $60-$70 million a year.

Additionally, Public Laws 99-145 and 100-456 require that the chemical stockpile be destroyed. Soon, there may be a bilateral or multilateral treaty requiring the destruction of the chemical stockpile.

The Department of the Army did extensive research with the help of industry and academia in the early 1980s to determine the most efficient method for destroying these chemical weapons. The method chosen was incineration and that result was endorsed by the prestigious National Academy of Sciences. The Army tests at the Chemical Agent Munitions Disposal System (CAMDS) determined incineration to be more efficient than chemical neutralization in destroying agent and results in less material in the waste stream. For incineration, the waste produced is 1:1, which means a pound of waste is formed for every pound of agent destroyed. For neutralization, the ratio is 4:1, which means 4 pounds of waste are formed for every pound of agent destroyed.

Currently, the only other process being studied by the Army is cryofracture, but this process also uses incineration as the means for destroying the chemical agents and munitions.

QUESTIONS SUBMITTED BY SENATOR ALAN J. DIXON

CHEMICAL MASK DRINKING SYSTEM

Senator DIXON. Mr. Secretary, for some time I have expressed interest in programs that are of immediate and direct benefit to the individual servicemen and servicewomen. One of these programs was a new Chemical Mask Drinking System. In December 1989, the Army advised me that the chemical tests for this program would be completed in March 1990. I understand that this schedule has been delayed. Can you explain what is causing any delay in this program?

Dr. RICHARDSON. There are two reasons for the delay in this program. First, test planning was delayed due to staff losses at the Chemical Research, Development, and Engineering Center, the agency responsible for testing the mask drinking system. Second, a legal review was required to determine the propriety of using procurement funds to conduct this testing effort. Both issues have been resolved and testing will begin April 30, 1990, with completion scheduled for August 31, 1990.

Senator DIXON. Isn't it reasonable, with the present day concern with chemical weapons, to expedite any programs that will protect the service people from this threat?

Dr. RICHARDSON. Yes, a reasonable approach is to expedite soldier survivability items if they are operationally effective and suitable. This determination is made through realistic operational testing. The Chemical Mask Drinking system is an example of an expedited program and will be tested to determine if it fulfills operational requirements.

Senator DIXON. Mr. Secretary, on page 12 of your statement you indicated that a contract award for 200,000 drinking tubes would be completed in the first quarter of fiscal year 1991. Does the Army have sufficient funds in the fiscal year 1991 budget to procure these tubes?

Dr. RICHARDSON. If the item successfully completes operational test requirements, the tubes can be procured with the funds provided by the Fiscal Year 1990 Defense Appropriations Act.

QUESTIONS SUBMITTED BY SENATOR PETE WILSON

Senator WILSON. Dr. Richardson, the Group of Seven industrialized nations, as you know, signed the 1987 Missile Technology Control Regime (MTCR) in which each government pledged to implement separate policies to deny the export of missile components to hostile second- or third-party end users. On May 2, 1989, the Deputy Assistant Secretary of Defense for Negotiations Policy testified before another Senate Armed Services Subcommittee that the MTCR had played a constructive role thus far in limiting missile proliferation but could stand some improvement on implementation by the United States. In light of the disturbing news that we have received over the past week on the expansion of Iraq's theatre missile capability, what aspects of the MTCR, in your opinion, can the Defense Department and our NATO allies use to more effectively control the spread of missile technologies to American adversaries in the Middle East?

Dr. RICHARDSON. First, we should have wider adherence to the MTCR among our allies. Eight NATO allies—the United States, Canada, the United Kingdom, France, Spain, Holland, the Federal Republic of Germany, and Italy— now adhere to the regime. The U.S. Government is actively involved in seeking wider adherence. Adherence means that a government has adopted the policy of controlling exports that could contribute to missile proliferation and has made the necessary adjustments in its export regulations to do so. Second, we should use the information exchange provisions of the MTCR guidelines to inform our various export control organizations of specific steps that must be taken to control missile proliferation.

Senator WILSON. Have we, in your opinion, consistently applied these regulations of the MTCR?

Dr. RICHARDSON. I doubt that any export control regime has ever been or will ever be applied with perfect consistency. However, perfect consistency is not necessary to hinder the proliferation of items as complicated as missiles, where tens of thousands of parts must be integrated in a device that works reliably the first time it is used. The administration has made great strides in improving the intra-agency and interagency processes to control missile related exports, and the consistency of our actions has improved accordingly.

Senator WILSON. Have we, in your opinion, adequately pressured our allies to control their own exports under the MTCR?

Dr. **Richardson**. "Pressure" is rarely necessary. Our allies are aware of the threat that missile proliferation poses to their national security. What is needed is the exchange of information to enable appropriate export control actions to be taken on a timely basis, and—with the exception noted below—we are doing even more in this area.

Senator **Wilson**. What implementation improvements do you think the United States has to make in its own application of the MTCR?

Dr. **Richardson**. The most urgent is to use our diplomatic establishment to attempt to prevent U.S. export denials from being undercut by other suppliers. We do this in many export control areas, but we are behind in our homework—by hundreds of cases—in missile export control. The idea is that when the U.S. Government denies an export application, we notify other governments whose firms could export a similar item and request them not to undercut our denial. When we get behind in this process, we do a disservice to U.S. firms that lose export business in a potentially futile gesture.

[Whereupon, at 3:45 p.m., the subcommittee was adjourned.]

DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEAR 1991

THURSDAY, MAY 3, 1990

U.S. Senate,
Subcommittee on Strategic Forces
and Nuclear Deterrence,
Committee on Armed Services,
Washington, DC.

ICBM MODERNIZATION

The subcommittee met, pursuant to amended notice, at 2:02 p.m., in room SR-222, Russell Senate Office Building, Senator J. James Exon presiding.

Committee members present: Senators Exon, Nunn, Levin, Gore, Wirth, Warner, Thurmond, Cohen, Wallop, Gorton and Lott.

Committee staff members present: Arnold L. Punaro, staff director; Madelyn R. Creedon, counsel; Kathryn E. Bognovitz, special assistant; and Lucia M. Chavez, research assistant.

Professional staff members present: Robert G. Bell, William E. Hoehn, Jr., and T. Kirk McConnell, professional staff members.

Minority staff members present: Patrick A. Tucker, minority staff director and counsel; Romie L. Brownlee, deputy staff director; Brian D. Dailey, Ronald P. Kelly, George W. Lauffer, and John E. Mansfield, professional staff members.

Staff assistant present: Mickie Jan Wise, staff assistant.

Committee members' assistants present: Andrew W. Johnson, assistant to Senator Exon; Kenneth N. Luongo, assistant to Senator Levin; Milton D. Beach, assistant to Senator Glenn; Leon S. Fuerth, assistant to Senator Gore; Terence M. Lynch, assistant to Senator Shelby; James M. Bodner, assistant to Senator Cohen; Patrick F. McCartan, assistant to Senator Wilson; Anthony H. Cordesman, assistant to Senator McCain; Thomas G. Moore, assistant to Senator Wallop; Robert M. Soofer, assistant to Senator Gorton; Charles G. Pearcy, assistant to Senator Lott; and Eric H. Thoemmes, assistant to Senator Coats.

OPENING STATEMENT OF SENATOR J. JAMES EXON, CHAIRMAN

Senator Exon. The subcommittee will please come to order.

The Strategic Forces and Nuclear Deterrence Subcommittee meets today to receive testimony on ICBM Modernization in review of S. 2171, the Department of Defense Authorization Act for Fiscal Year 1991.

Our witnesses are Mr. Franklin C. Miller, Deputy Assistant Secretary of Defense for Nuclear Forces and Arms Control Policy, and Maj. Gen. Stephen B. Croker, Director of the Strategic, SOF and Airlift Programs for the United States Air Force.

Gentlemen, I want to welcome you before the committee. We are delighted that you are here today.

A lot has changed since the Congress reached decisions on ICBM modernization in last year's conference on the fiscal year 1990 Defense Authorization Act. In that legislation, Congress approved most of the funds requested by the administration for Rail Garrison MX and the Midgetman programs. In the conference report accompanying the bill we said, and I want to quote, "by these actions the conferees strongly reiterate their support for the administration's two ICBM missile programs."

Since the conferees signed off on that report, the Berlin Wall has crumbled, the Warsaw Pact has disintegrated and the conventional threat to NATO has greatly diminished. At the strategic level, Soviet modernization has continued at a robust pace, although the CIA Director Webster noted in testimony before this committee there have been some important, positive changes in this area as well. These include the Soviets' scaling back on the production rate of certain strategic weapons to reflect likely START limitations; the reduction, for the first time, in the number of Soviet strategic launchers as older systems were retired more rapidly than new ones were being deployed; and the cessation of Yankee class SSBN and Bear-H nuclear patrols off our coasts.

In recent weeks the ICBM picture has been affected by two other important developments. First, President Bush proposed that the two sides explore and start an accelerated movement toward greater ICBM de-MIRVing, starting with a ban on mobile MIRVed ICBMs such as the Rail Garrison MX and the SS-24. President Gorbachev has reportedly replied that any such discussion must include limitation on highly accurate MIRV SLBMs such as the Trident-D5. As of now, the future of this initiative remains uncertain.

Second, last month press reports indicated that the Air Force was prepared in its fiscal year 1992-1997 POM submission to delete funding for rebasing the MX on rails. Secretary Cheney stated that the administration's position remains that they support Rail Garrison.

Gentlemen, we hope that you will be able, in your testimony and the questions that will follow this afternoon, to help us sort through the implications of all of these developments for our ICBM Modernization Program.

Before calling on Mr. Miller, I would be pleased now to recognize the ranking member, Senator Thurmond, to see if he has any opening remarks.

Senator THURMOND. Thank you, Mr. Chairman.

I want to join you in welcoming the witnesses to the subcommittee. I look forward to their testimony and hope it will provide the subcommittee with a clear understanding of the administration's position on the ICBM Modernization Program.

There have been numerous press reports asserting major changes in the Air Force position on ICBM modernization. I hope this issue can be clarified today.

Mr. Chairman, before we hear testimony from the witnesses, I want to make a few comments and observations about recent events in the Soviet Union and their impact on U.S. defense spending and strategic force modernization.

For nearly 30 years the United States has relied on a nuclear triad for deterrence and global stability. This combination of land, sea and air-based nuclear systems has been extremely successful in fulfilling our most basic objective, deterring war between the United States and the Soviet Union. Recent events in Eastern Europe and the Soviet Union require a reexamination of our military strategy and requirements.

In doing so, we must be careful not to confuse changes in declared intentions with objective assessments of Soviet capabilities. I have had the privilege of serving in this distinguished body for well over 30 years. During that time I have heard many declarations by Soviet leaders about changes in intentions or pronouncements for reform within their country.

Many of my colleagues have quickly embraced these declarations by Soviet leaders, only to later see these promises go unfulfilled or worse, result in a change in Soviet leadership. During these periods of so-called change, many of my colleagues considered Soviet declarations of change to be irreversible and unprecedented. We hear many of these same words today.

Mr. Chairman, admittedly there have been changes in the Soviet Union, although the degree to which most of them are irreversible is still very much in question. Additionally, the implications of those changes for U.S. national security are far from clear. Yet many of my colleagues are quick to call for dramatic cuts in defense, even before we fully understand the implications of Mr. Gorbachev's initiatives. In short, I am concerned that while we may have won the cold war, we could very easily lose the peace.

Moreover, in looking at the changes in the Soviet Union, we have seen little change in Soviet strategic forces. While their strategic modernization program is probably being conducted within the context of a possible START Treaty, that effort should not be trivialized. When their modernization program is finished, Soviet strategic offensive and defensive forces will be completely modernized. They will have completely modernized their ICBM force, which includes two new classes of mobile missiles and a more lethal heavy missile, the SS–18.

They will have two new classes of SSBNs and two new sea-launched ballistic missiles. The Soviets will also have two new bombers and associated air-launched cruise missiles, for which the United States has no air defense remotely comparable to that of the Soviet Union to counter this threat.

In contrast, the United States is struggling to sustain a consensus on ICBM and bomber modernization. While we have been successful in modernizing the sea-based leg of our deterrent force—providing we can resolve the nuclear weapons complex problem—serious questions remain as to whether we will have a modern land- and air-based deterrent force for the 21st century.

With respect to ICBM modernization, the fragile consensus that has been forged over the years shows increasing signs of fracturing. I have been willing to support the development of a two-missile program. But I am concerned that we may find ourselves in the position of sacrificing the mobility option for the Peacekeeper program due to political and budgetary problems and consolidate funds for the Small ICBM, only to lose that more expensive program 1 or 2 years from now.

Such an outcome would be highly destabilizing, particularly under the proposed START treaty being negotiated in Geneva and continued Soviet deployments of a rail- and road-mobile ICBM force.

Even with all the changes in the world, we must not lose sight of the importance of maintaining a modern and credible nuclear triad. The only basis upon which the Soviet Union can claim its status as a superpower is on its enormous and powerful nuclear capability. Given the state of the Soviet economy, this fact will not change anytime soon. While we may be able to reduce the size and capability of our overall military forces, given the lessening conventional threat in Eastern Europe, our strategic nuclear deterrent must remain modern and credible in order to maintain strategic stability. The Soviet strategic nuclear threat has only changed on the margins.

Given the trend in Soviet strategic modernization and the potential for instability in the Soviet Union due to their domestic and economic problems, our nuclear deterrent must remain. I repeat, must remain, in both perception and reality, uncontestable to any foreign power.

Mr. Chairman, I look forward to hearing the testimony of the witnesses and further discussing the problems we face in maintaining a consensus on ICBM modernization.

At this time, I would like to insert for the record the opening statement of Senator Pete Wilson.

Thank you very much.

[The prepared statement follows:]

PREPARED STATEMENT BY SENATOR PETE WILSON

Mr. Chairman, I appreciate this opportunity to present my views on the critical issue of ICBM modernization.

I am concerned about media reports suggesting that some Air Force officials have recommended an adjustment of America's strategic triad by downgrading land-based mobile ICBMs.

Despite the multiple political and military changes occurring in the Soviet Union, Mr. Chairman, neither the awesome Soviet nuclear arsenal nor the need for the United States to maintain a flexible deterrent triad have disappeared.

During the series of military threat assessment hearings that the Senate Armed Services Committee held earlier this year, a variety of witnesses of differing-political philosophies, professions, and areas of expertise all repeated the view that Moscow's strategic nuclear modernization programs continue to develop and grow.

The Soviet Union now deploys more than 470 ICBM warheads while the United States deploys none. The Soviet Union quietly installs two new generations of land-based intercontinental ballistic missiles—the SS-24 and the SS-25—while Congress and the Pentagon loudly argue their way into a gridlock over different weapon systems and basing modes.

And the Soviet Union, Mr. Chairman, has decisively chosen rail- and road-mobile ICBMs while we have debated this issue for more than 10 years without a resolution.

We must, as Secretary Cheney and the President have warned, measure Soviet capabilities rather than intentions or rhetoric. As a result, we still-have the obligation to build upon a strategic nuclear triad that has effectively prevented war and kept the Soviets at the negotiating table.

The mobile peacekeeper system plays a vital role in supporting the credibility of this triad because it adds yet another element of doubt in the Kremlin's planning for whether the Soviet Union could win a nuclear exchange with the United States.

ICBM mobility complicates Soviet war strategy by increasing the risk that an offensive launch would fail to cripple American land-based nuclear forces beyond any capability to respond. The accuracy of ICBMs also reminds Moscow that the United States could still strike hardened Soviet targets as well as command, control, and communications centers even after a first strike on our own territory.

These propositions, Mr. Chairman, do not stand as Defense Department fantasies. Marshall Sergei Akhromeyev, President Gorbachev's most intimate military advisor, testified before the House Armed Services Committee last summer that "mobile ICBMs . . . provide for more stability against strikes. That is why they can be legitimately developed and deployed by both sides."

Mobile ICBMs, therefore, enhance deterrence, and deterrence guarantees peace—just ask the Soviet leadership.

The Secretary, therefore, has made a prudent budget request for rail cars to accommodate existing Peacekeeper missiles, and I urge my colleagues to support this initiative in the interest of going forward with the modernization of America's strategic deterrent forces.

Senator Exon. Thank you, Senator Thurmond. Gentlemen, we are in open session today. We have no closed session planned. If, during the discussion or questions, we get into areas that cannot be discussed openly, I would just remind you to caution us if we get into an area that you think would be better served in a closed session. And if so, we may have a closed session after we finish the open session, if anything of that nature does come up.

With that, I am pleased to recognize you, Mr. Miller. Your full statement has been submitted. Without objection it is incorporated in full as a part of the record. And if you could summarize that statement now, it would be very much appreciated.

STATEMENT OF FRANKLIN C. MILLER, DEPUTY ASSISTANT SECRETARY OF DEFENSE FOR NUCLEAR FORCES AND ARMS CONTROL POLICY; ACCOMPANIED BY STEPHEN B. CROKER, MAJOR GENERAL, USAF, DIRECTOR OF STRATEGIC, SOF AND AIRLIFT PROGRAMS

Mr. Miller. Thank you, Mr. Chairman. It is a distinct pleasure for me and my colleague, General Croker, to appear before the committee. Let me summarize my statement.

As you pointed out in your opening remarks, Mr. Chairman, a great deal has occurred over the last six months. And in light of what has occurred, the question has been asked why is strategic modernization still important now.

Despite all the positive change in Eastern Europe and the prospect for change in the Soviet Union, we must not forget that the United States has never faced a more formidable and modern nuclear arsenal than that of the Soviet Union today. As you pointed out, while they are tailoring the ongoing modernization of their forces within what we appear to believe are limits driven by the START Treaty, they are modernizing across the board.

That modernization is marked by the new SS-18 mod-5, much more accurate than its predecessors; the 10-warhead SS-24 in both its silo-based and rail-mobile mode; the road-mobile SS-25; two new bombers, the Blackjack and the Bear-H; two new air-launched missiles; the Delta IV and Typhoon submarines; and follow-ons that are in development for those systems.

If a START Treaty is successfully completed and ratified by the Senate, the total Soviet warheads facing the United States will decline under that treaty, but a formidable Soviet arsenal will remain. And as a result, we will need to have a strong, survivable and modern deterrent. Reductions in U.S. strategic forces under START place a premium on flexibility, survivability and a hedge against unforeseen developments that might occur.

With regard to unforeseen developments, very few of us could have predicted accurately all the changes in Eastern Europe and the U.S.S.R. which have indeed occurred over the last 6 months. In part, this has been because the Soviet Union itself has been extremely unpredictable. And based on this, it is difficult to place much confidence in our ability today to predict what will occur in the future in the Soviet Union. A crises in leadership could result in further unpredictability, which could have serious adverse consequences for the West. Our nuclear deterrent and investment in strategic defenses provide a hedge should that occur.

In this regard, we must remember that the decisions we make today will have significant long-term implications for our force structure. The systems we are currently developing are systems that will make up our strategic deterrent well into the next century. We should not cancel vital elements of our future deterrent now, based on positive developments of the last 6 months, when no one can predict what lies in store for us in the next 10 to 20 years.

Since the early 1960s, the triad has been the backbone of our deterrent posture. What is different is that, whereas in the 1960s we were able to modernize all three legs simultaneously, we are not able to do that today. Programs are stretched and phased, as the committee well knows, in order to make them affordable.

But we need a modern triad. We need it to protect against technological breakthroughs, which would threaten deterrence. We need it for security under reduced levels of forces, because we cannot be left in a post-START world with aging systems while the Soviets have modern ones.

Finally, we will need an effective offensive deterrent, in order to pave the way for a transition to a more stable deterrent, founded on a mix of both offensive and defensive strategic systems.

Our programs do span all three legs of the triad. The committee was briefed last week by Secretary Cheney on the bomber programs, where we are relying on the B-2 as the penetrating bomber and on the air-launch cruise missiles to form our mix of both stand-off and penetrating systems. The new, quieter Trident submarine with the D-5 missile is the centerpiece of SSBN modernization. We have quickly recovered from last fall's technical problems with the D-5, and the first Trident SSBN with D-5 missiles on board commenced a deterrent patrol last month.

Part of the Trident program also calls for the back-fit of the D-5 missile into the first eight Trident submarines which currently carry the Trident I. Moving to all D-5 force in this way has a number of advantages: increased range, improved military effectiveness and streamlined and more effective logistics supportability. As we near the end of this decade, all of our Poseidon submarines will be retired, leaving a much smaller Trident force for our sea-based leg. But that much smaller Trident force will be more survivable and more effective than the original fleet of 41 Polaris SSBNs.

The third leg of the Triad, and the focus of today's hearing, is our ICBM Modernization Program, which includes rebasing 50 Peacekeeper missiles from silos onto trains and proceeding with the small missile program. We are looking forward to the Peacekeeper on rails being operational in late 1992 and the redeployment of all 50 missiles completed by 1994. And on the small missile program, research and development continues. And we plan to begin deployment of the Small ICBM late in 1997.

The Department believes that the President's two-missile program represents sound strategic, fiscal and arms control policy.

Proceeding now with the Rail Garrison allows us to employ our most mature technology with the least technical risk at the lowest cost. And it can be done quickly.

The Peacekeeper would be survivable with a minimum of strategic warning. I would note that as Soviet forces withdraw from Eastern Europe, we would expect to have more strategic warning than we have today.

The second step of the program, the small missile, allows us to complete an orderly development effort designed to lower this missile's costs. Still pending are decisions on the ultimate configuration of the missile and on where it will be based. In phasing the small missile program to follow Rail Garrison, we defer the largest part of its cost until the mid- to late-1990s, when we will be better able to afford it.

Both the Peacekeeper Rail Garrison and the small missile are mature concepts. We have been working on them as the Committee knows and has supported throughout the 1980s. The need for ICBM modernization is just as valid today as it has been for well over a decade. We still need an ICBM force as part of our triad, and we still need an ICBM force that is survivable and resilient to Soviet attack. Unfortunately, while we have been debating whether to have one, zero or two mobile-missile systems, the Soviets have proceeded to deploy two of their own.

The President's program on ICBM modernization is completely consistent with our objectives in START. Our force modernization objectives and our arms control positions are serving to shift the Soviets away from their own reliance on large, fixed ICBMs. And it would, indeed, be ironic if we succeeded making the Soviets go mobile but did not do so ourselves.

We find ourselves now at a critical crossroads. We are asking for funds to begin deployment of Peacekeeper Rail Garrison and for money to continue to research and develop the Small ICBM. We seek your support, mindful of the ongoing negotiations in Geneva and the upcoming summit this June.

We believe we have a fully integrated strategic program consisting of modernization, research into effective strategic defense and arms control. It fits our START requirements and is compatible with present fiscal restraints.

Mr. Chairman and members of the committee, we thank you for the opportunity to appear before you to outline the President's programs. General Croker and I are ready to answer any questions you might have concerning these vital programs.

[The prepared statement of Mr. Miller follows:]

STATEMENT
BY
MR. FRANKLIN C. MILLER
DEPUTY ASSISTANT SECRETARY OF DEFENSE
NUCLEAR FORCES & ARMS CONTROL POLICY

Mr. Chairman and Members of the Committee,

It is a distinct pleasure for me to appear before you today to testify on the President's strategic modernization program and, in particular, the ICBM modernization effort.

Some may question, given what has occured over the last six months, why strategic modernization is still important. The recent events in Eastern Europe offer hope that democracy can replace communist forms of government, and do so in such a fashion that may not provoke hostilities between NATO and the Warsaw Pact, or the Soviet Union with one of their former client states.

Despite this positive change, we must not forget that the United States has never faced a more formidable, modern nuclear arsenal than that of the Soviet Union. Their ICBM force has been modernized by introduction of the SS-18 mod-5 missile, the silo-based 10-warhead SS-24 and its rail-mobile counterpart, and the road-mobile single-warhead SS-25. The Soviet bomber force has been augmented with two new air-launched missiles and the new Blackjack and Bear H bombers. The Soviet Navy now has the new Delta IV and Typhoon submarines, each equipped with modern MIRVed missiles. Without question, the Soviets are modernizing their forces towards the limits that will be specified under an agreement in START.

If a START agreement is successfully negotiated and ratified, the total number of warheads threatening the U.S. will decline over the duration of such a treaty. Nevertheless, the overall threat posed by the impressive post-START Soviet weapons will remain. As a result, the United States must continue to have a strong survivable and modern strategic deterrent. While the political, social, and economic circumstances in both the Eastern

Bloc, and to a lesser extent, the Soviet Union, may have moderated near-term Soviet intentions, these changes have done nothing to alter the strategic threat directed towards the United States. Mr. Gorbachev is not dismantling the Soviet strategic arsenal as part of his economic and political revolution in the Soviet Union. While we negotiate -- indeed, after we sign an agreement -- the United States must continue to maintain its military strength at a level designed to the keep the peace.

We cannot dismiss the fact that peace has been preserved for over forty years by our nuclear forces, and over thirty of those years with the Triad -- bombers, submarines, and ICBMs.

Since the early sixties, the Triad of strategic forces has maintained the peace. Through the years, the Department's strategic modernization efforts have focused on improving each leg of the Triad. In the 1960's, in those days when Defense garnered a larger portion of the overall Federal budget, we modernized all three legs of the Triad at a rapid pace. This is not the case today. Programs are stretched and phased in order to make them affordable while proceeding at a pace that minimizes the risk to U.S. national security interests.

Nevertheless, we need a modern Triad for a number of reasons. We need a Triad to protect against a technological breakthrough which could act to nullify one or more of the three legs and thereby threaten deterrence. We need it for security under reduced levels of forces. Modernization is needed in order to maintain deterrence at reduced START levels; the U.S. cannot be left in a post-START world with aging systems, while the Soviets have modern ones. And, finally, we need an effective offensive force in order to pave the way for a transition to a more stable deterrent founded on a mix of both offensive and defensive systems.

Current efforts to maintain the effectiveness of the Triad do include programs for all three legs. A mixed force of standoff and penetrating bombers will place the maximum stress on Soviet air defenses, which the Soviets continue to upgrade and which will not be limited by START. The B-2 is the focus of our modernization effort for the penetrating bomber force, while the Advanced Cruise Missile will extend the utility of our aging B-52 force well beyond its original life cycle. Modern, highly survivable strategic bombers not only provide the flexibility to place a full range of targets at risk, but have the added ability to be recalled or redirected after they are launched.

The new, quieter Trident submarine with the longer range and more accurate D-5 missile is the centerpiece of SSBN modernization. We have quickly recovered from last fall's problem in testing the D-5 at sea, and the first Trident SSBN -- the USS Tennessee -- went on patrol with the D-5 last month. The Triad program reflects the importance of ensuring our strategic forces are more survivable, and at the same time affordable. The Trident SSBNs, coupled with the D-5 missiles, represent a significant modernization improvement over existing systems which have begun the retirement phase of their life cycle. Part of our Trident modernization plan also calls for the backfit of the D-5 missile into the first eight Trident submarines that currently carry the C-4 missile. Moving to an all D-5 force has a number of advantages: increased range, improved military effectiveness and streamlined and more cost-effective logistics supportability. Increased range not only adds targeting flexibility, but enhances SSBN survivability by expanding operational patrol areas for the submarines. Having a common missile will reduce logistics and training support costs.

As we near the end of this decade, all of the Poseidon SSBNs will be retired, leaving only Trident SSBNs for our sea-based leg. With the Trident, the United States will maintain a smaller, affordable SSBN force which is nevertheless more survivable and more effective than our original fleet of 41 Polaris SSBNs. Our current Trident program and build rate is fully compatible with START.

ICBMs are the third leg of the Triad and the focus of this hearing today. The President's ICBM Modernization program includes rebasing 50 Peacekeeper missiles from Minuteman silos onto trains kept in garrisons at seven of the Strategic Air Command's bases throughout the United States. Delivery of the first operational unit is planned for late 1992 with the redeployment of all 50 missiles complete in 1994.

The second part of the President's two missile program is the Small ICBM. Research and development continue on the missile. We plan to begin deployment of the Small ICBM beginning late in 1997.

The President's two-missile program for modernization represents sound strategic, fiscal, and arms control policy. Proceeding with Peacekeeper Rail Garrison allows us to employ our most mature technology and basing approach now. This approach has the least technological risk and the lowest cost, can be done quickly, and would significantly enhance stability and deterrence. In the Rail Garrison basing mode, Peacekeeper will be survivable with a minimum of strategic warning -- and I would note that as Soviet forces withdrew from Eastern Europe we would expect to have more strategic warning than we have today.

As the second step of the phased approach, the Small ICBM allows us to complete an orderly development effort designed to lower this missile's costs. Decisions on the ultimate configuration of the missile and on the deployment location must be made as part of this effort. By phasing Small ICBM deployment to follow Rail Garrison, we defer the largest part of its cost until the mid- to late- 1990s when we may be better able to afford it.

Some may question the need for these ICBM programs. Mobile missile systems such as the Peacekeeper Rail Garrison and the Small ICBM on Hard Mobile Launchers are needed for several fundamental reasons. They are survivable; they enhance stability;

they are not first-strike weapons; and, they are affordable in today's era of scarce resources. Mobile ICBMs diminish the advantage to the Soviets of striking first, and thereby strengthen deterrence.

Both the Peacekeeper Rail Garrison and the Small ICBM are mature concepts. We started down the road of building mobile missile systems under President Reagan in 1983 when the Scowcroft Commission recommended the three-step approach to ICBM modernization: (i) deployment of the Peacekeeper missile into existing Minuteman silos; (ii) the development of the Small ICBM deployed in a mobile basing mode; and (iii) the redeployment of the Peacekeeper missiles in a more survivable basing mode once such a mode was found. Many of you in this hearing today voted for the recommendations of the Commission. In 1986, after the initial deployment of Peacekeeper in silos, rail garrison was selected as the most cost-effective basing mode to make the missile more survivable.

The need for ICBM Modernization is just as valid today as it has been for over a decade. We still need an ICBM force as a part of our Triad, and we still need an ICBM force that is survivable and resilient to a Soviet attack.

I cannot help but observe, however, that while the United States has debated over the past decade the alternatives of one, two, or no mobile missile systems, the Soviets have proceeded to build two of their own. There are no indications that they are going to stop building potent mobile force. The bottom line is that they are modernizing their strategic rocket forces to the limit permitted under START.

The President's ICBM modernization program is completely consistent with U.S. objectives in START to move toward more stabilizing forces. The Soviets have deployed over 20 SS-24 missiles, each with 10 RVs in a rail-based configuration. To have similar forces is not only stabilizing, but will eventually serve to facilitate future negotiations on these forces. Our force modernization efforts and arms control position are serving to shift the Soviets away from their heavy reliance on large, fixed ICBMs. It would be ironic if we succeeded making the Soviets "go mobile," but did not do so ourselves.

We are now at a critical crossroads in the development of both systems. We are asking for funds to begin deployment of the Peacekeeper Rail Garrison at the seven locations announced last November. We are also asking for money to continue research and development of the Small ICBM program. We are seeking your support mindful of the ongoing negotiations in Geneva and the upcoming summit this June.

The President has a fully integrated strategic program consisting of force modernization, research into an effective strategic defense, and arms control. It all fits together. From a fiscal standpoint, the Strategic Modernization Program not only fits our START requirements, but it is compatible with present fiscal constraints.

We need only about four percent of the defense budget to accomplish our modernization goals for FY91. This program is consistent with the changing events in Eastern Europe and the Soviet Union. We need to move forward with it and we need your continued support.

Mr Chairman and members of the Committee, I thank you for the opportunity to come before you and outline the President's modernization programs. I am ready to answer any questions you may have concerning these vital programs.

Senator EXON. Thank you.

General, do you have an opening statement?

General CROKER. No. I fully support the positions as outlined by Mr. Miller.

Senator EXON. We will begin the first round of questioning, and I would ask that the timekeeper follow the usual procedures.

Mr. Miller, there seems to be a great amount of confusion reaching us from a series of sources on what is and what is not the ICBM modernization proposals of the services and possibly some disagreement between the services and the Office of the Secretary. Has the Office of the Secretary of Defense told the Air Force, either formally or informally, that it will not countenance a submission by that service of a fiscal year 1992-1997 Program Objective Memorandum that eliminates funds for the rebasing of the MX on rails?

Mr. MILLER. Senator, I can only repeat, I think what Secretary Cheney said to this committee a week ago, and that is we have not yet received the Air Force proposal. So, we cannot even comment on that. I know personally of no such communications. But then the Air Force POM, the Air Force budget submission, as I understand it, will be delivered to the Office of the Secretary of Defense within about one week and a half.

During that period following the submission, throughout the summer, we will be reviewing the Air Force submission along with the submissions of the other services. At the moment, the Department of Defense has a single program for ICBM modernization. That is what is before you in the President's budget. The Secretary of Defense supports that, and any internal budget deliberations that we might make, I simply cannot speak to. But we do not have the Air Force budget and we cannot comment on it yet, sir.

Senator EXON. Have you heard, Mr. Miller, or have you been informed officially or otherwise, that indeed the Air Force is likely or about to make a recommendation that such funds for the transfer of MX on Rail Garrison might be recommended to be deleted by the Air Force?

Mr. MILLER. I have this story, Senator Exon, as have we all in the press. I can only repeat again, the Secretary, up here last week when you were discussing the B-2, indicated his firm support for the Peacekeeper Rail Garrison program. He considered it a highly important element of our deterrent and for the small missile program. That is his position and that is the position I carry forward today.

Senator EXON. General Croker, let me ask you this question. Why did the Air Force, if the Air Force did, initially draft a fiscal year 1992-1997 program plan for deleting funds for rebasing the MX on rails? Has that preliminary decision by the Air Force now been reversed?

General CROKER. Without trying to quibble, Senator, I think it is technically inaccurate to say that the Air Force has deleted funding for Rail Garrison basing. The Program Objective Memorandum you mentioned is a bi-annual event and each of the services, as you know, has to submit projections for funding.

The POM is fiscally constrained, much more this year than in years past. The guidance starts from OMB and is further apportioned by the Secretary. We have received that fiscal guidance, and it is rather dramatic in the choices it forces us to make.

The POM process has not even really begun. The POM is going to the printers this week. The review process will begin in about one week and a half, as Mr. Miller outlined. After the Secretary reviews the POM, not only with the services, but through the offices of the Joint Chiefs with the CINCs and they have an opportunity as well to submit their prioritized list, then the Secretary submits his final decision to the President.

It would be personally awkward for me and inappropriate to comment on the Air Force POM at this time in any more detail.

But, again, I think the press reports have had some measure of inaccuracy in them.

Senator **Exon**. Well, General, I do not want to quibble either. But we have got to get the message across to the administration and we have got to get the message across to the uniformed services that we are in the midst of budget deliberations and considerations here. As a member of the Budget Committee, yesterday we made some decisions based upon certain assumptions. We are pawing around in the dark up here because you have been so slow in making your determinations.

I must tell you, General, that the Congress knows that the Air Force was prepared to support this action. Do you expect that the Congress might not be asking some questions as to what in the world is going on now and why we are disappointed that you cannot be more forthcoming in our meeting today than you have been so far? Do we understand that you are under wraps and are not prepared to comment any further than the statements you have made thus far?

General **Croker**. Well, sir, again, the process takes almost one year. We start our POM submission in the late winter, early spring. We go through and talk to the various major commanders, in this case, General Chain and others, and try and craft the Air Force POM, given the fiscal guidance we have.

Then, in the spring and summer, we go through the issue cycle with the OSD staff to allow the Secretary of Defense the chance to put his imprint on all of the service POMs and talk with the JCS and line up competing demands and make a final choice and go to the President.

So, I think it is not fair to say that things are under wraps or that we are slower than normal. We are following the normal process. The Air Force supports the President's budget that is on the Hill for the two-missile programs. We have had a number of very hard choices to make in 1992 and I think it would be unfair to the Secretary of Defense, before he has even had a chance to review the POM, for us to start the deliberations on that document.

Senator **Exon**. Well, General, let me just say this. We, on the Committee, think we have a pretty good understanding of what the Air Force intended to recommend. We recognize and realize that the Secretary of Defense always has a right to override any recommendation from the uniformed services. But I would simply say that the MX Rail Garrison proposition is in big trouble here. Since we know what the Air Force recommended, and whether or not the Secretary overrides that, this knowledge is going to have a bearing on what we do here.

One last question. Has the administration yet made any decision concerning the eventual Midgetman force size, the basing locations or the re-entry vehicle configuration? If not, when is it likely that such decisions will be made and available to us?

General **Croker**. Sir, as I understand it, we have structured our acquisition policy for the small missile so that the base line program is a 37,000 pound missile. You remember several years ago it grew from 30,000 pounds. That has not changed. We are planning initially on a northern basing at Minuteman bases. The Secretary of Defense, in earlier testimony, mentioned a force size somewhere between 250 and 500 and said that the force size would ultimately be decided, probably in this next POM but we will retain the option for southwest basing in fiscal year 1992. In other words, we are structured to go either way.

We are also similarly structured to go either way on a number of re-entry vehicles. But the baseline program is one re-entry vehicle, and there have been no significant changes.

To summarize, I think our tentative plans are a maximum of 500 missiles; initially northern basing with 500 missiles, that would be three northern Minuteman bases; and a one RV program. But, we really will not know which way the administration chooses to go until fiscal year 1992. We are protecting both options.

Mr. MILLER. Could I comment further, Senator?

Senator EXON. Yes, Secretary Miller.

Mr. MILLER. As you recall the SICBM program was restructured following President Bush's review last spring. One of the principal goals was to develop the missile but to keep the cost down. That is why we were looking at a two RV version as well as a one RV version and the cost of the various basing modes also differ. So I think where we are going to come out is a decision in the late 1991 or 1992 time frame on the SICBM configuration, basing mode and force size. We are working to try to keep the cost of that down as much as we can. Those are the trade-offs involved.

Senator EXON. Just a little editorial comment and then I will yield to Senator Thurmond. In listening to the testimony, I suspect that it might be safe to assume that the Administration is not going to make its final determination in these areas until some time after the START agreement, if one is reached, to see what direction is being taken by the Soviets. Is that a fair editorial comment?

Mr. MILLER. I think it will probably work out that way, Senator. It was not intended that way at the beginning, but I think it will probably work out that way.

Senator EXON. Thank you. Senator Thurmond?

Senator THURMOND. Thank you Mr. Chairman.

General Croker, if we do not complete the two mobile missile programs, is it your opinion that the continued validity of the triad is in doubt?

General CROKER. It is my personal opinion that, if we do not have a modernization of the bomber force and the ICBM force, that the efficacy and validity of the triad will be in some jeopardy, if not immediately, by the end of the decade. Yes, sir.

Senator THURMOND. Mr. Miller, in your statement, you allude to the transition to a more stable deterrent based on a mix of both offensive and defensive systems. Would you please explain how mobile ICBMs contribute to this transition?

Mr. MILLER. A more stable world, Senator Thurmond, would involve one in which neither side possessed the capability to target much of the other side's forces. The mobile ICBM programs are designed on our part to remove from the Soviet targeteers the ability to place our systems at risk and so to make it harder for the Soviets, under any circumstance, to contemplate attacking our forces.

The whole thrust of the modernization effort there, the START effort to reduce large, heavily MIRVed, silo-based systems in favor of slower flying systems and therefore to enhance stability that way, and the research and other efforts going on within the SDI program are designed, again, to foster less of a reliance of heavily MIRVed, fixed silo-based missiles, which we believe are destabilizing, to focus more on stabilizing, mobile, slower flying systems.

Senator THURMOND. Mr. Miller and General Croker, either can answer. What is the average age of the Minuteman III force?

General CROKER. Sir, it is about 19 years old. I do not know precisely and I will provide that for the record. Because you have the Minuteman IIs, 450 of those were first deployed in about 1965, and then 500 Minuteman IIIs in about 1971. So, the average for the entire Minuteman force is well past 20 years.

Senator THURMOND. What is the cost of extending the life of the Minuteman III system?

General CROKER. There are several programs underway, Senator, to extend the life of the Minuteman III. We have several common features between the Minuteman II and the Minuteman III. The stage 1 and stage 2 motors are the same. We have done some stage 2 and stage 1 rework. The cost of that, for example, in 1990, the cost of the stage 2 washout was $9 million and $4.6 million in 1991.

We have $18 million forecast for stage 3 motor work in Minuteman IIIs in 1991. We are upgrading the computer terminal in all of our systems, but starting out in the Minuteman III. There will be $102 million in 1991 for REACT. We continue to do the RIVET MILE modifications, which basically are civil engineering upgrades to both the silos and the launch capsules, because, as you know, things buried underground are subject to corrosion and we have to periodically check to make sure that the nuclear hardness is maintained.

I would say to you that there is an active and vigorous program going on. It is not of large magnitude, but we do have a 20-year plan that we are pursuing for the Minuteman III.

Mr. MILLER. Sir, the Minuteman IIs were deployed in the middle of the 1960s, the Minuteman III beginning in 1971. It will become increasingly harder over time to keep those Minuteman IIs viable if only because the system is so old that it needs major block replacements of some of the guidance systems if we are going to keep it well on for the next 20 years.

So, of the two elements of the Minuteman force, maintaining the Minuteman III is a much less costly proposition for the next 20 years than would be maintaining the Minuteman II.

Senator THURMOND. General, what did you say it cost to extend the lives of the Minuteman III system?

General CROKER. Well, I gave you a number. I broke down the cost, Senator. I would have to summarize that. I will do that for the record. But roughly, I would say in fiscal year 1991 less than $200 million for the Minuteman III upgrades.

Senator THURMOND. Please break it down and provide it for the record.

General CROKER. Yes, sir, I will do that.

[The information referred to follows:]

MINUTEMAN III SYSTEM

There are several planned and ongoing life extension programs for Minuteman III. Fiscal year 1991 funding levels for these programs are:

Stage III Remanufacture - $18.8M
REACT (Appr 3020 and 3600) - $184.9M
MK 12 and MK 12A Flight Test Assets - $24.0M

There are several programs to replace aging and unsupportable depot maintenance support equipment, test equipment, and trainers planned for the outyears of the SYDP. These programs are not designated as life extension programs per se, but they are necessary for continued support of the weapon system. These are generally smaller programs, however, and specific funding levels for these programs as well as outyear funding levels for these programs as well as outyear funding levels for the procurement programs mentioned previously are still being reviewed in the POM.

Senator THURMOND. Would the Minuteman III be deficient in any way?

General CROKER. No, sir. I think the Minuteman III is a quite viable program. As Mr. Miller indicated in Minuteman II, particularly in the guidance area, by 1995 that is going to become logistically unsupportable unless we make a modification or a change. But the Minuteman III seems to be a quite viable and robust system.

Senator THURMOND. For how long would the life extension of the program be good? 1995? 2000?

General CROKER. Sir, we have a plan right now, a 20-year engineering plan. So, in theory, based upon what we know today, it would be, I would say safely, good through between the period 2000 and 2010 for the Minuteman III. Again, the Minuteman II has some problems, significant problems, starting in 1995.

Senator THURMOND. Mr. Miller, some analysts have argued that it is unfair to say that the Minuteman force is old because we have engaged in a number of life extension programs or upgrades for these systems, making them equivalent to new missiles. Is this a fair assessment?

Mr. MILLER. I would not call them new missiles in any way, Senator. They are strong elements of the deterrent right now. The Minuteman III, with the newer warhead, has considerable capabilities across a wide spectrum of targets. The original Minuteman III less so because of its smaller warhead.

They are good systems now. But they are aging. It just depends how much money we want to spend to be able to procure new stages, wash out the existing missile stages and pour new motors, to spend money to upgrade the guidance. The one thing that those systems cannot do which the new systems can do is to move. That is, these are silo-based systems, and they are there on day-to-day alert. They are there right now. They would be there in a crisis. They would be there in a period of war.

The mobile systems could be moved. They could be hidden in the Nation's railnet and elsewhere on the basing for an SICBM, and they could enhance stability and deterrence when it was most needed. Unfortunately, a silo-based missile just cannot do that.

Senator THURMOND. As part of that same question, can we really consider the Minuteman force to be a new generation missile system similar to generational changes in the Soviet missile force?

Mr. MILLER. No, sir. Not in any way.

Senator THURMOND. Thank you very much. My time is up.

Senator Exon. Thank you, Senator Thurmond. Senator Levin.

Senator Levin. Thank you, Mr. Chairman. Let me add my welcome to our witnesses.

It is no secret to anybody on this subcommittee that I have opposed the MX. I have not felt it is worth the billions of dollars either to produce in its original mode nor do I think it is worth billions more to move from one basing mode to another. It just makes no sense to move the MX from silos which are hardened, 200 times as hard, by the way, as they will be on these railroad trains, to those railroad trains.

The MX is not designed to survive a surprise attack on those railroad trains. The only time it would survive would be when we have about 8,000 other survivable warheads, when our subs and our planes have been generated because we have some kind of strategic warning. In a surprise attack the MX will not survive on railroad cars. It is not designed to survive unless we launch on warning, which is not a policy that we choose to be forced to adopt.

So I just do not think it makes sense in this kind of environment, surely, but in any event I do not think it makes sense militarily to move those to railroad cars which again, are not mobile except in the very unusual event, which has occurred only a few times in 40 years, where we have had some kind of strategic warning.

8,000 survivable warheads, I believe, is more than adequate deterrent and will remain more than adequate deterrent. This is true even if the Soviets doubled the number of their warheads, we still have the same number of 8,000 survivable warheads to deter because our planes will still survive, the ones that are generated, and our subs will still survive, even if the Soviets doubled or tripled the number of warheads in their inventory.

And, so, deterrence is strong now and will continue to be strong. The likelihood of nuclear war is even reduced from what it was because everybody felt that the most likely path to a nuclear exchange would be through a conventional war and that prospect has now been reduced.

But those are views I have held for some time. There is nothing new in that.

What strikes me, however, what is double disturbing about spending billions of dollars to put the MXs on railroad cars is that we would be, I believe, taking some risks that we need not take just in terms of production of those cars and the procurement of those cars prior to the time that we have completed our testing.

That is what I want to focus on, as to whether or not we are not putting the cart before the horse, whether or not we are buying before we are flying, whether or not we are not engaging in absolutely needless concurrency.

Now, we have had some recent experience with concurrency around here. It was called the B-1. We took some real risks on concurrency with the B-1, and as a result we ended up with a B-1 that did not do the job that it was supposed to do. We had to pay for the fix in order for it to come close to the job that it is supposed to do, and the ECM did not work. That was because we bought the ECM on the B-1 before we had tested it.

Now, as I understand, it is proposed to procure about one-third of these trains in fiscal year 1991, and that is before the operational test and evaluation process begins. Is that an accurate fact, General, that we will be procuring about one-third of the MX trains in fiscal year 1991 and that that is before the operational test and evaluation process begins?

General **Croker**. Sir, I think that is a simplification, and I would like to clarify if I might. We have had 20 tests of the Peacekeeper missile, 20 live firings.

Senator **Levin**. I am talking about the trains here.

General **Croker**. Yes, sir. We have had 20 live firings of the Peacekeeper missile. It has been the most accurate program and the most successful missile test program in the history of the U.S.' missile programs, sea and land based.

The CEP is far better than we thought it would be. When we went to milestone 2 in this program there were two areas of technical risk. One was whether the guidance would work well in the horizontal mode as it moved on the rails. The other was whether the launch car, the rail launch car and the rail bed, could stand the impact of launch. Both of those technical risks have been resolved positively.

We have already done the cold launch tests of the missile, sufficient weight and impact on the rail car and the rail bed as would be experienced during a live missile launch. We have operated the rebuilt engines on the Rail Garrison that we are procuring, for 17 or 18 years. None of the rail cars themselves are unique or unusual beyond the missile launch car itself.

So, I think the argument for concurrency itself in terms of test is probably overstated.

Senator **Levin**. Let me read the GAO report here. "According to the Air Force's current acquisition milestones, no operational test and evaluation of the complete Rail Garrison weapons system will have been conducted at the time the initial production decision is scheduled to be made." Is that true?

General **Croker**. It is true that the integration will take place after the purchase of the first seven production trains.

Senator **Levin**. All right. So that statement of the GAO is true. You disagree with the conclusion; I understand that. But I want to make sure you do not disagree with the factual statement that no operational test and evaluation of the complete Rail Garrison weapons system will have been conducted at the time the initial production decision is scheduled to be made.

General **Croker**. No, sir. I was merely trying to make the point that this is an integration program, a modification. It is in no way, shape or form similar to the activities we undertook with the B-1, which was started from development basically from scratch.

Senator **Levin**. I just want to know if I can get a clear answer. Is that statement of the GAO accurate?

General **Croker**. Yes, sir.

Senator **Levin**. It is. My time is up. Thank you.

Senator **Exon**. Thank you, Senator Levin. Senator Wallop would be next.

Senator **Wallop**. Let me ask the following question to that. The statement of the GAO is accurate. Is it relevant?

General **Croker**. No, sir. That is the point I was trying to make to Senator Levin. I think, so that everyone understands, we decided at the last milestone to accept a measure of concurrency. But I ask you to understand that it was a concurrency in integrating an existing proven missile and an existing train system.

To eliminate concurrency, we also estimated that it would take about 24 months and about 700 million additional dollars. So, for two reasons, the Air Force and the Defense Department elected to go ahead with the program as Senator Levin has described it (a) to keep the costs low and (b) because it was a matter of integrating proven systems and not developing a brand new weapons system.

I think it is consistent both from the arms control point of view as Mr. Miller outlined and also along the guidelines that Senator Nunn has outlined in his desire to take existing weapons programs and modernize them or improve them rather than replace them. So, I think the statement, while accurate, is not relevant.

Senator WALLOP. Thank you, General. Let me follow on a little on the MX. The benefits, at least to some of us, of the rail basing are self-evident: It does not require a new missile. The mobile ICBM force can be fielded within 2 years, and that gives it affordability and cost-effectiveness and that gives us an increased survivability of the ICBM leg of the triad, thus contributing both to recent arms control framework agreements and to a concept that has been advanced by many who have not supported missiles generally that mobility is more stable than fixed-based silos.

But if we fail to take advantage of the benefits of the MX Rail Garrison, what are the equal or similar benefits of other systems or alternative courses of action that the Air Force might pursue in lieu of MX rail, and how long might they take for us to achieve them?

Mr. MILLER. Could I start with that, Senator?

Senator WALLOP. Please.

Mr. MILLER. I think the first point I would make is that there are no near-term alternatives, that we have phased the programs to be affordable and the earliest we could have the Small ICBM is 1997. One of the reasons the administration placed highest priority on the Peacekeeper Rail is so that we could have the first ones in 1992 and the entire set of 50 by 1994.

I think what is very important is that we go back to the whole triad concept. Senator Levin said that even without systems there are 8,000 survivable warheads. The whole point of the triad is to have three independent legs that serve as hedges. If you write off the ICBM force and say the bombers and the submarines will survive, that is perhaps true, given what we know today. But should there be some sort of a breakthrough in Soviet anti-submarine warfare, then two out of three legs are held at risk. If, in the opinion of the Department, we do not proceed with the B-2 program, then the applicacy of the bomber leg over time is at risk.

It is not a question of what is survivable today. The question is do we have, in the full triad, three legs that provide hedges against one another. Failing to go with the mobile missile programs and failing to go now with the Peacekeeper Rail Garrison starts to put a question mark over the triad.

Senator WALLOP. Thank you for that. Now, I want to go on a little bit, given then the triad and its survivability. And given the anxiety that arises from leaks to the press from some statements, General Croker, that appeared to emanate from the Air Force, and some statements that would appear to reflect the same kind of thinking that Senator Levin has advanced, that the Air Force has perhaps shifted to the view that our ICBM deterrent force is a deterrent in being, in other words, a force whose military utility does not encompass the possibility of its actual use.

There would be one line of reasoning that would say, well, there is still 8,000. There would be one line of reasoning of saying that there is no point in modernizing it. There would be one line of reasoning reflected in the Air Force's supposed view, and that is one of the reasons why it is important for this committee to try and find out what its real view is, that they would recommend cancellation of that funding.

Would either of you or both of you comment on that?

General **Croker**. I understand the question that Senator Exon originally asked, and I understand the question that you have asked, sir. Again, I am not, as forthrightly as I can say, the Air Force is not intending to cancel the MX program. There are no near-term alternatives to mobility for the Peacekeeper missile. There is no other quick solution. There are no Minuteman mobility solutions.

Senator **Wallop**. So far as you know, then, the Air Force views the missile leg of the triad as weapons to be used and not weapons to be used to showcase our deterrence, should that occasion occur?

General **Croker**. One of the very important advantages of Rail Garrison, to get back to Senator Levin's question, is that without increasing the number of weapons threatening the Soviet Union as you do when you generate more submarines or more bombers, since the ICBM force is basically 100 percent on alert in a period of increased tension, if you were able to deploy the Rail Garrison on strategic warning, you basically make the weapons system inaccessible to the Soviet planner and therefore, to attack, so you enhance stability in a crisis period.

Since the Soviets can no longer hold the missiles at risk, and the share of our strategic deterrent force at risk, then I think it is more than a theory, but our belief is that you would enhance stability in a crises and try and assist in returning the crisis back to the pre-crisis stage, which is different than your question about its actual use.

Our indication is that the accuracy of the Rail Garrison system would be virtually as good as the accuracy in the silo, so there would be no war fighting loss by putting the Rail Garrison on trains.

But to get back to your original question, there have been a number of questions emanating from this committee which has been very crucial to our support for the two-missile program. There have been a number of other developments that are quite honestly causing the Air Force to re-evaluate all of its programs.

Couple that with the very, very serious and significant fiscal climate, and we have got to make some very hard choices. I think it would be less than candid if I say that the Air Force is not exploring every program it has. But I want to assure you that the Air Force supports the President's program and it will support the President's program as it comes out of the 1992 POM. But at this point, it would be misleading to tell you that we have canceled the Rail Garrison program because that is not true.

Senator **Wallop**. Thank you.

Mr. Chairman, my time is up.

Senator **Exon**. Thank you very much, Senator.

Let me just return for a moment to the question that was first brought up by Senator Levin. Given the answers that you have made in answer to questions today, it seems to me that it would be fair to say on the concurrency issue that you do not have a problem with the firing of a missile from a rail car bed. But it is true, is it not, that you have not tested this system in place with a control car with the whole system as it would be envisioned to go out on the rails. Is that right?

General **Croker**. That is accurate, Senator. We will do the five basing verification tests starting in mid-1992, calendar year, and completing them in mid-1993. There will be five live firing tests from a completely integrated train. The point I made to Senator Levin is that the two areas of technical risk were moving the guidance platform and seeing about the impact on the missile car and the rail bed. And we have satisfied ourselves about both of those technical uncertainties. In other words, we have subjected the rail car to the same force of impact of launch and, again, the missile——

Senator **Exon**. You went through all of that. But if someone wanted to criticize you they could say that you have not tested the full system with regard to the operational car and the control car and so forth?

General **Croker**. Yes, sir. We have tried to balance the integration problem, the technical risk problem and the cost problem. The concern over spending an additional $700 million to achieve that level of non-concurrency or to eliminate the concurrency is a source of considerable concern to the Air Force. That is why we made the decision the way we did.

Senator **Exon**. Thank you General. Senator Gore.

Senator **Gore**. Thank you very much, Mr. Chairman.

I would like to say to the Air Force and to my colleagues on the Committee that before the Air Force and the administration makes any decision on this question you should understand that there are those of us who are prepared to support both missiles and have been for some time. I have made no secret of my long-held opinion that eventually our land-based deterrent force should be comprised of single-warhead systems and that the force of the Soviet Union should as well.

But we are some distance from that outcome. I recognize that and continue to recognize it. I simply want to say for the record that I remain prepared to live up to the compromise approach which has long been worked out among people with differing views. One reason is that I think domestic consensus on strategic forces is itself a strategic asset.

In whatever way the administration finally resolves its intentions on this matter, I trust and hope and expect that appropriate regard for the importance of consensus will be maintained.

Now, that having been said, I do believe that the administration is now in approximately the right position, although there are still rumbles of dissent. It has been a long haul since 1983 for those that have supported the Scowcroft Commission report. I see a few faces in this audience of people who have been there for all that time.

I would like to just briefly restate its fundamental premise: reductions are not enough; stability is needed. De-MIRVing is the most accessible path to stability. Submarines give us a fantastic and survivable deterrent force, but putting all of our eggs in one basket indefinitely is extremely unwise because there are readily imaginable ways in which submarines could become highly vulnerable. They are not there yet. Maybe they will never be there.

But they sure could be. With all the advances in science and technology and measuring systems and monitoring systems and understanding of the basic processes of the ocean, one would be extremely foolish to assume that submarines will indefinitely be invulnerable. I hope they will be. But, we cannot bet the farm, much less the survival of our Nation, on that assumption.

General Scowcroft spoke last week at a rather extraordinary forum that has been going on for years run by Peter Huessy. He said that START alone will not produce stability, and a mobile ICBM force is needed to produce stability. With START almost over we have to make choices with START II in mind. Choices that make sense for START I in isolation do not necessarily make sense across a START II environment.

I take note of the reports that we have now formally offered to move toward a single-warhead regime. I take note that Soviet strategic spokesmen have repeatedly over the last several months expressed the open desire to do exactly that. Their reported objection to our first offer in the negotiation is not convincing to anyone who has seen Soviet bargaining strategy over the last several years.

I would hope that we do not tamper with the one RV configuration. I looked at your statement, Mr. Miller, and read between the lines there—not too much. I understand what you are saying. But please understand what I am saying. The essential logic behind a single RV system has been accepted by the Soviet Union, by the President's National Security Advisor and by a growing consensus of strategic thinkers in both superpowers. The complications introduced by a two RV system would be extremely disquieting. Moreover, it would be no option for southwest basing and inter alia.

And so, I am essentially encouraged but want to caution about the extreme importance of respecting the strategic asset, which is consensus. I hope we will be able to achieve it and to build on the progress which I think is under way.

Rather than asking any questions, I just talked to myself. I realize now that my time is up. But, I am confident that Senator Cohen will ask some brilliant questions. I will just be interested in the answers.

Thank you, Mr. Chairman.

Senator EXON. Thank you Senator Gore. Senator Cohen.

Senator COHEN. Mr. Miller, in response to the Chairman's question, he asked you whether or not the analysis was going to be completed of the POMs and the current review that is taking place before or after the START Treaty, hopefully negotiated in June. And you said it was not intended to be completed after, but that is the practical——

Mr. **Miller**. No, sir. If I said that I did not mean to. The POMs themselves will be analyzed this summer. A decision will be made this fall. What I meant to say was that a final decision on the small missile, that is, how many RVs and where it will be based, is planned for 1991–1992. That alone, just the President's program for making a decision on the small missile. And I take all of Senator Gore's points. The reason we are looking at the two RV configuration is for cost.

Senator **Cohen**. You also indicated, I believe, General, that a failure to go to the MX Rail Garrison leads to the undermining of the triad?

Mr. **Miller**. I said that, sir.

Senator **Cohen**. If the Soviets agree to eliminate their mobile MIRV systems as part of an agreement, would that undermine the triad?

Mr. **Miller**. I think we would have to look at the context of all of that.

Senator **Cohen**. I mean, the mere fact that you do have a MX Rail Garrison per se, does not mean you do not have a triad if you have, in fact, an agreement to eliminate the land-based MIRVed mobile systems.

Mr. **Miller**. In my personal judgment, Senator, one of the things that would remain after that unaddressed is still the very large Soviet investment, even under START, cut by 50 percent of the SS-18 force. I think we need to make decisions based in that context.

Senator **Cohen**. You also indicate that having a common missile for the Trident, I think, reduces logistics and training support costs. How much will the logistics and training costs be reduced compared to the option of retaining C–4 missiles in the Trident?

Mr. **Miller**. My understanding—and we will get back to you for the record—but my understanding is if you look from now until about the year 2010 or 2015 the Navy estimates that staying with the C–4 program, the C–4 missile in the first stage submarines, would cost us in excess of $1.5 billion, perhaps larger.

If I could explain that for a minute, it is the two separate logistics and support infrastructures instead of one for a single missile. It is the possibility that over time, as the C–4 ages—and it was introduced in 1981—that we might have to come up with a new missile to replace that around the end of this century, and so we would have to come up with another new SLBM, and it is all of those unknowns, but at least $1.5 billion.

Senator **Cohen**. What does it cost to retrofit the existing Trident boats to put the D–5 in instead of the C–4?

Mr. **Miller**. Each submarine, including the missile complement is a $750 million cost to be accomplished during the first overhaul. The $1.5 billion is on top of all of that. It is the net after the cost of the D–5 backfit is eliminated and the savings for C–4.

Senator **Cohen**. The cost figure that I have is roughly $6 billion to backfit the Trident with the D–5.

Mr. **Miller**. Then it would be $1.5 over that, at least $1.5 over that to keep the C–4s, and that does not speak, if I might for just a moment, that does not speak to the military problem you get with the D–5. You get better accuracy, you get longer range missiles, and also by having Trident D–5s in both oceans. There is a military benefit whereby JSTPS could have packages swapped from ocean to ocean, which they could not do with separate missiles.

Senator COHEN. What is the administration position on the possibility of reducing the number of tubes on the Trident sub?

Mr. MILLER. For a follow-on agreement?

Senator COHEN. For START purposes. In other words, the committee last year in its authorization bill said let us look at two options, the one sealing up some of the tubes on the Trident and, number two, taking down the total number of eight warheads per missile down to something like seven or six. What is the administration position?

Mr. MILLER. I think our judgment—and we have not reached a position—is that we do not need to address that in START I, that both are viable alternatives for START II, but for START I we have succeeded with the Soviets in negotiating a set-aside for at least two submarines in overhaul. That is, if you had a force of 20 Trident SSBNs in overhaul, only 18 would count for START purposes. So, we are currently looking at an SSBN Trident force size of around 20 or 21 submarines that could be with an overhaul exemption a force of 23 submarines overall.

We believe that we can get 18, 19, 20 submarines within START I limits without downloading or sealing tubes.

Senator COHEN. The joint summit statement says that if either side changes the number of warheads declared for a type of deployed ballistic missile, the sides have to notify each other.

Mr. MILLER. That is correct, yes, sir. And we are aware of downloading. We are working a downloading provision in the negotiations.

Senator COHEN. Let me ask you back on B-2. What is—Secretary Cheney told the committee it is an absolute requirement of 132 B-2 bombers to carry out the SIOP missions. What has changed which now allows the Air Force to come forward with 75 instead of 132 aircraft?

Mr. MILLER. Working where I do, you would be surprised to hear me say that Secretary Cheney came forward with that. But the Air Force supports it. That is, enough has changed in Eastern Europe that there have been some relaxations of requirements. And, as the Secretary indicated last Thursday in the major aircraft review discussions, we have been undergoing for some time a review of the SIOP and of strategic deterrent requirements which at an appropriate time he might be prepared or would be prepared to discuss in a classified setting.

Senator COHEN. As recently as, let me say, within 4 or 5 weeks General Chain sat at that table and said he needed an absolutely requirement of 10,000 warheads. Now that has changed in the last month.

Mr. MILLER. I will not speak to what General Chain said, sir, but——

Senator COHEN. He is the man sort of that makes the assessment and tells us what the target requirements are.

Mr. MILLER. I can read you a brief colloquy from the House side. When Representative Kasich said that—it is not long ago when General Chain was up here saying we needed 132, and now you are telling me less than 60 days later we have a new set of targets. Secretary Cheney says call it civilian control. We have a process underway looking at all other national requirements, and it has been going on for some time.

Senator COHEN. In other words, it is being driven not by the budget, but by changing circumstances in Europe and changing threat from the Soviet Union.

Mr. MILLER. Changing circumstances overall and reviewing our overall national requirement.

Senator COHEN. But it is not the budget that is driving it.

Mr. MILLER. The Secretary would prefer to have 132 aircraft, but the budget will drive it down to the 75 number.

Senator COHEN. Could I just—in general I was intrigued with your response to the Chairman's question when he asked whether or not the press reports were true about the reduction or a potential reduction of the funding for the Rail Garrison. You read a very carefully scripted response. And it is one thing for us to read questions in that fashion, and it is quite another for you to read your responses. [Laughter.]

Senator COHEN. I was wondering whether or not that statement has been cleared by your superiors and by OSD.

General CROKER. Sir, I was aided in my very careful response by the gentleman immediately behind me, Mr. Betourne, who works for Mr. Miller. And the reason it is careful is because I wanted to make sure that I had accurately responded to the question that I think Senator Exon and you and Senator Wallop had asked in all good faith.

Part of the issue gets back to Senator Levin's question on concurrency, and there are people who share Senator Levin's view, particularly in the Department of Defense that there is some more concurrency than they prefer to see in the program. And so one of the alternatives the Air Force has explored is how you would financially structure the program to eliminate the problem that Senator Levin talks to.

And I think part of the difficulty has come up because while a group of staff members were at Offutt, they were informed by a captain in SAC that the Air Force had deleted some funding or had proposed to. And the captain did say that. Again, there was a level of inaccuracy in there, but we have attempted to explore a bunch of different options.

Senator COHEN. Was it inaccurate that he said it or was it that he misspoke?

General CROKER. No, sir. He spoke accurately as to his belief of what was transpiring. I would only say to you that when he made that statement, the Air Force did not even know what the Air Force POM position was going to be yet because I was in the process of trying to find out myself, and it was not as he characterized.

Senator COHEN. Let me ask you then. Hypothetically we have a funding profile of the Small ICBM that calls for $555 million in fiscal year 1992, $598 for fiscal year 1993 and $765 for fiscal year 1994. Hypothetically if the Air Force were to propose reducing that funding profile in half, in your judgment would that result in the effective termination of the small missile program?

General CROKER. We are talking small, now, right?

Senator COHEN. Yes, sir.

General Croker. What we have done with the small profile, again?

Senator Cohen. No, that is not what I asked you. Take that response away.

General Croker. I am just looking at my funding profile, sir.

Senator Cohen. Do not go through the numbers again. But hypothetically if you were to reduce the current funding profile for 1992, 1993, 1994 and you were to reduce it by 50 percent in your judgment, would that for all practical purposes terminate the small missile program?

General Croker. Sir, if we did anything to the funding profile in those three years, it would have a very significant impact on the small missile program because right now, as you will remember, when we restarted the small program in the first year, there was only $100 million, and we got the committee's approval to reprogram some money from Rail Garrison to small and brought it up to $200 million. So basically there is a very limited amount of dollars in the program today.

We are stretching out the test program, doing some request for proposals with the contractor, but I think your characterization on the small missile is true—that if we diminish those funds by half it would, for all practical purposes, eliminate the small missile program as we understand it, coming to fruition in 1997.

Senator Cohen. Can you tell me in one final question: Have all of the verification issues relating to the Rail Garrison MX been resolved?

Mr. Miller. No, sir.

Senator Cohen. What are some of the issues that remain?

Mr. Miller. There are a large number of issues.

Senator Cohen. You know, we do not have much time. Gorbachev is coming.

Mr. Miller. There are a large number of issues which relate to the movement of the trains to the numbers, to the trackage that is allowed in each particular facility to how the trains themselves are monitored. An equal number applies to the road mobile system. There is a lot of work that has yet to be done in those areas.

If I might, Senator Cohen, I want to be very clear on my previous answer to you because it is important. The Secretary's own review of national strategic requirements began some time ago, and that has been going on. Obviously, the budget crisis focused us on the number of B–2s and in the Major Aircraft Review, given what is underway, given his own views on already existing work that has been done, and given the budget, he came up with the 75 number on the B–2s.

I do not want to suggest that the budget is not a part of the B–2 number, but I do want to be very clear that it is not the budget that drove this, the overall review of strategic requirements that began quite some time ago.

Senator Cohen. Thank you, Mr. Chairman.

Senator Warner. Mr. Chairman, could I ask one quick question?

Senator Exon. I was about to thank Senator Cohen and recognize you. You would be next.

Senator Warner. Thank you, Mr. Chairman. It will just be a quick one.

If a President, most particularly this one, wanted to have the option to accelerate the small missile program by, say, 1 or 2 or 3 years, is it possible and what steps would have to be taken in this budget to give him the option if he might wish to exercise it in the next fiscal year or the year following, whichever witness wishes to tackle that.

General **Croker**. Sir, right now the initial force is planned, the initial capability is in 1997. It would be difficult to accelerate that significantly without a large number of dollars. My own information is that for an extra billion dollars spread over 1991, 1992, 1993 we could possibly accelerate the small missile perhaps 15 months at some considerable risk. That is not a program that we recommend, but it is an option we have looked at in response to query from your staff.

Senator **Warner**. Thank you. Thank you, Mr. Chairman.

Senator **Exon**. I believe we are prepared to begin our second round. Do you have any further questions, Senator?

Senator **Warner**. Only would that be on top of the present program classed for the 1997?

General **Croker**. Yes, sir. That would be a billion additional dollars spread over 1991, 1992, and 1993 to accelerate the IOC perhaps 15 months at high risk.

Senator **Warner**. Thank you, Mr. Chairman.

Senator **Exon**. Thank you, Senator Warner. We will begin our second round, then, at this time.

Mr. Miller, at a committee hearing last Thursday Secretary Cheney said, and I quote, "the Warsaw Pact is no longer a target-rich environment from the standpoint of our SIOP, so you can begin to change your planning assumptions about how many systems you are going to need to deliver weapons to targets because the target base is going to be smaller."

That matter of a smaller target base had been brought up in some of the previous questions that have been asked of you today. Given this, has the Defense Department begun a review of all of our targeting requirements for the decade that lies ahead? If so, how far are you into this review?

I recognize that this would have to be in the context of START assuming that START is signed and confirmed and ratified by the Senate. Where are you on this overall planning process which I think we of this committee particularly need as we look forward to the next 5-years?

Mr. **Miller**. We are well into it, Senator. This was—the Secretary initiated this review last year. It is an across-the-board review, looking at the situation that prevails today and looking ahead into the future. I hesitate to give you a date as to when it will be completed because it is a review that delivers products in various phases to the Secretary and responds to his further direction. But there has been a lot of work done.

Senator **Exon**. Well, given the fact that you have responded to various questions here about the reduced threat that we all know and that particularly came up, I think, with regard to the reduction from 132 to 75 for the B–2 program. Therefore, my question is given the fact that Secretary Cheney recommends reducing B–2s from 132 to 75, essentially on a reduced targeting need, does this reduced targeting requirement also affect our plans for either the rebasing of the MX on Rail Garrison or the procurement of the Midgetman?

Mr. MILLER. Let me say first, Senator, if I might that it is not so much as I read what the Secretary said that the 75 B-2 number is not based on a reduced targeting need. What he said is that changing conditions in Europe and elsewhere allowed us to assume a broader level of risk in that given the fiscal problems it was prudent to go from 132 to 75. He did not tie it specifically to targeting requirements. And so it is a broader assessment of risk and where the world is going.

The comment that you made about Peacekeeper Rail Garrison and SICBM I think can be answered in the following way. The Peacekeeper Rail Garrison does not give us any more warheads. What it does is, it gives the President a very important option should things go wrong in the future, should a crisis develop in which the Soviet Union and the United States were in a serious confrontation. But making those 500 existing warheads untargetable by the Soviet Union and thereby increasing stability.

The small missile program would also give the President the capability to disperse warheads and make them untargetable. The number of small missiles that we would buy would depend on our targeting requirements, and I would expect that when the department comes forward with a number that it would reflect the results of ongoing work based on our strategic requirements. But one point is the mobility is essential in any event and has very little to do with targeting requirements and, two, with Peacekeeper we are not adding any new warheads and, three, I think that the SICBM number would be based on an assessment of our strategic requirements broken out among the legs.

Senator EXON. General, let me ask you this question. The GAO noted in December of last year that 73 percent of the operational Rail Garrison MX trains would be, according to the current Air Force plan, acquired before March of 1992, on the full rate production decision when it is made and, of course, based upon completed operational tests and the evaluation program.

Now, given that, what is wrong with slowing the schedule so that these cars are not produced until after a final production decision given what we have heard today and based upon a completed operational test and evaluation program? Is that a part of your thinking?

General CROKER. Sir, as I explained earlier, it has been a part of our thinking. We have looked at this issue that Senator Levin has raised very carefully. There are two years worth of purchases of trains before we published the AFOTC report and now its results, and that has been a consideration. I think the driving factor in this climate is the added time it would take to deploy the trains—about 2 years—and the added expense of scheduling the program along the lines Senator Levin suggested—that $700 million additional expense is a significant concern to the Air Force in this fiscal climate, and there is an imperative to try and get some mobility as quickly as possible and the Rail Garrison offers the opportunity to do that.

Again, we felt that was not a development issue, but rather an integration issue, and we identified the two areas of technical risk at Milestone II, and we have had subsequent tests that assure us that those technical risks are low and manageable. So, yes, we have examined it and, yes, there is a cost, and cost is a very weighty factor.

Senator EXON. General, given the ongoing discussions between the Soviet Union and the United States and assuming that we have a START agreement and that after the START agreement we would begin to talk about START II—where there would be an effort to ban mobile MIRVed missiles, I think Congress is somewhat hesitant to move ahead too quickly on the Rail Garrison MX. Given this, we might want to stretch out the schedule for construction of the operating bases for the Rail Garrison MX. The question is if the 1991 request were funded in full, how many Rail Garrison MX bases would be built with those 1991 funds?

General CROKER. We are basically doing the bulk of Francis E. Warren first with the 1990 dollars in 1991, to answer your question specifically. We would start the military construction on bases two, three, and four. So, the 1991 dollars, if you withheld them, would affect the military construction at the second, third, and fourth base. It would affect a facility at Newark Air Station in Ohio that has to do with guidance, and it would affect a facility at Ogden in Utah that has to do with missile maintenance and storage.

Senator EXON. I would like to ask you to please submit for the record for our consideration a funding profile that would reflect possibly a policy decision to only build one Rail Garrison MX a year, starting in 1992 and assume full 1991 funding. If we had that from you, it would be helpful to us when we get down to mark-up on these various programs. Could you supply that to us for the record?

General CROKER. Yes, sir.

[The information referred to follows:]

RAIL GARRISON MX

The following funding profile represents a restructure for the current Rail Garrison Program, deploying one garrison per year. This profile supports a First Asset Delivered (FAD) of December 1992 and a Full Operational Capability of December 1998.

PEACEKEEPR RAIL GARRISON
(TY $ IN MILLIONS)

	FY89/P	FY90	FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	TOT
QTY TRAINS			4	4	4	4	3	3	3			25
3600	872	774	548	293	121	25	7	7	7	7	7	2682
3020		103	911	551	634	519	439	452	562	91	94	4432
3300	17	116	105	87	131	84	84	102				726
TOTAL PROGRAM	889	993	1564	931	886	628	530	561	569	98	101	7840

Senator EXON. One last question. How fast are we moving on the construction of hangars, those $4 million hangars, one each for the B-2? I understand, then, since we have reduced the buy to 75 that we would need only 75 of these $4 million hangars, that is if the Air Force has their way.

There is considerable activity going on at the present time at Whiteman Air Force Base. How many B-2 hangars are presently under construction at Whiteman?

General CROKER. Sir, I do not have the number of hangars under construction available at this time, but I do have some information, if you are interested, that General Chain had reworked to reflect your concern over the hangars—the number of hangars and the cost of hangars. I recall, there are seven hangars under construction, but I would like to submit that for the record, sir. I just cannot be positive about how many are under construction at this moment.

Senator EXON. Submitting that for the record would be perfectly acceptable.

General CROKER. All right, sir.

[The information referred to follows:]

CONSTRUCTION OF HANGARS

There are six aircraft facility projects at Whiteman under construction at this time. They include: two B-2 Maintenance Docks, one B-2 Corrosion Control facility, one B-2 Fuel Cell Maintenance facility and an alteration to an existing aircraft maintenance hangar that will accommodate two B-2s.

Senator EXON. Thank you. Senator Thurmond.

Senator THURMOND. Thank you, Mr. Chairman.

Mr. Miller, if Congress does not fund the Small ICBM force in either silos or in road mobile configuration, what impact will this have on our ability to meet deterrence requirements under a START Treaty?

Mr. MILLER. I think what it would do, Senator, is to reduce the confidence we would have in the ICBM leg. I think it all goes back, as we were saying at the beginning of the discussion, to the Triad. What we would like the Triad to do is to have each leg provide an insurance policy against a failure of the other legs. Both the Peacekeeper Rail Garrison program and the SICBM program were designed through mobility to address the current silo vulnerability of the Minuteman peacekeeping force. What it would mean is you would keep missiles in silos and you would not have the ability to make them mobile and the ICBM force could not serve well as a hedge, should there be a problem in the future in the bombers or in the SLBM leg.

Senator THURMOND. Mr. Miller, either you or General Croker can answer this. Can the Administration provide the Congress with an idea of what the post-START force will look like? If you cannot supply specific structure, what would be the general allocation of ICBM warheads under the 4,900 sub- limit for ballistic missiles?

Mr. MILLER. Senator Thurmond, we have not yet fixed on the exact break-out between ICBMs and SLBMs under the 4,900 limit. I believe that last fall we supplied the Congress with a report that gave four alternative post-START mixes that ranged from, I think, one force with 1,000 ICBM warheads up to another force that had up to 2,000 ICBM warheads under the 4,900 ceiling. It is our current intention not to make a final decision until negotiations are complete and we can decide exactly how best to break that out.

Senator THURMOND. Mr. Miller, would you endorse or support a START Treaty if Congress did not fund or approve a smaller ICBM in silos or in a road-mobile configuration and did not fund the deployment of two B–2 wings? What impact would this have on maintaining the credibility of the Triad into the 21st century?

Mr. MILLER. Senator Thurmond, I would like to reserve what my judgment would be on START, but let me address the question by saying failure to fund two wings of B–2s would undercut the bomber leg of the Triad. The failure to move with SICBM and Peacekeeper Rail Garrison would undercut the ICBM force, and as Senator Gore was pointing out earlier, the SLBM force is secure. It has a highly accurate missile. It is highly survivable today, but if you undercut the bomber and ICBM legs you are putting all of the Nation's eggs is one basket. That strikes me as a risky proposition, and it is not something that I would look forward to with any enthusiasm at all.

Senator THURMOND. General Croker, for years the Air Force has prudently maintained the Advanced Strategic Missile System program as a research effort in advanced technologies for ICBMs, but for fiscal year 1990 the Appropriations Conference eliminated all funding for such projects as an earth-penetrating warhead. Do you believe that specific authorization language is needed to protect these projects?

General CROKER. Yes, sir. It would also be helpful to have specific appropriations language. We got good support from this Committee and from the House Armed Services Committee. The difficulty with the earth-penetrating warhead as it is associated with ballistic missiles came from the Appropriations Committees, but it would definitely help, as it has in years past, to have your strong support to pursue that technology.

Senator THURMOND. Mr. Miller, the research project on the earth-penetrating warhead has been attacked as somehow improper because it could attack Soviet leaders in their shelters. Is it your view that such targeting is entirely consistent with the Nation's strategy and targeting policy?

Mr. MILLER. Senator, we have, throughout the entire period of our nuclear deterrent, felt that we had to hold at risk among other things the Soviet leadership, so that the Soviet leadership had to understand that if it attacked us our retaliation would destroy that leadership's ability to survive and to command and control the Soviet Union in a post-World War world. There is nothing new about that.

What was new at the beginning of the 1980s is that we began to discover a great deal of information on the deep underground bunkers. The deep underground bunkers were specifically created to undercut our deterrent, and I think we have taken into account that we need to continue to hold at risk Soviet military capability, Soviet leadership capabilities and their war-supporting industry, and if they are going deep underground, then we have to have a deterrent that says to them, you can go as deep as you want, but you should never consider attacking the United States because our retaliation would deprive you of the things that you would look forward to in a post-war world.

Senator THURMOND. Mr. Miller, in your statement you referred to the Soviet strategic modernization program. Why do you suppose they have given such emphasis and resources to strategic modernization, given all the economic problems the Soviet Union faces?

Mr. MILLER. I do not pretend to be a Sovietologist, Senator Thurmond, but it seems to me that the Soviets' sole claim to superpower status rests on its military forces. What is striking to all of us, and as Senator Nunn and Senator Warner and others have remarked over the past several months, the Soviets are beginning to take down some of their conventional forces but they are keeping their strategic nuclear forces at high levels and are keeping them modernized.

There has been some slowing of effort in their strategic modernization, but it has been very much on the margins, and while people continue to predict that fiscal constraints will inevitably force the Soviet Union to reduce its strategic modernization, we have not seen that yet. We just have not seen it in the ICBMs, the SLBMs or the bomber programs.

Senator THURMOND. My time is up, Mr. Chairman.

Senator EXON. Thank you very much, Senator Thurmond. Senator Levin?

Senator LEVIN. Thank you, Mr. Chairman. General, I understand that your testimony basically is that we will be saving some money if we proceed to procure the MX Rail Garrison cars prior to even the beginning of the operational testing on that integrated system, and that the Air Force, at least so far, has decided that it would cost more money if we held off for the testing to begin, and you do not want to spend that money, which you have estimated at $700 million. Is that kind of a fair summary of where you are?

General CROKER. I would prefer to say that the technical risks are entirely acceptable. We have already done a number of tests. We have done the sled test, where we have moved the guidance around. We have launched the shape from the rail car. The only test that we will not have done is the live firing and the base verification test.

Senator LEVIN. Those are operational tests though, are they not?

General CROKER. Yes. Those are the five basing tests. We will not have completed those.

Senator LEVIN. You will not have begun the operational tests, as a matter of fact.

General CROKER. Yes, sir, that is correct. I am sorry, I misspoke.

Senator LEVIN. I think this is important, because I think there has been a little confusion about that. You will not have begun the operational test at all, until after the production decision is made.

General CROKER. Beyond the tests I have already described, your statement is accurate, yes, sir.

Senator LEVIN. But is it not fair to say that within the general meaning of the words "operational test," that you will not begin the operational tests, even on the components, prior to the decision on initial production?

General CROKER. Yes, sir.

Senator LEVIN. So that when we spoke before, and you and I had a discussion about whether the operational testing of the integrated system would begin prior to the production decision, you said that that would come afterwards, but you are satisfied that the risk is low relative to each component. You were then not suggesting—or you did not mean to suggest—that the operational test would begin on the components prior to the decision on production?

General CROKER. I did not mean to suggest that. The formal AFOTEC assessment, the Air Force Operational Test Evaluation Center, begins in February 1992.

Senator LEVIN. Again, I think this is a very important point so I am going to repeat it. There was an implication, I believe, in the prior exchange, that it was only the operational testing on the integrated system which would come after the production decision, but in fact it is the operational test within the usual meaning of the words on the components which will also begin after the production decision.

General CROKER. Perhaps what I failed to hear originally, or your emphasis at least on it, was the word "operational," because there is considerable development testing, and you know the test forces these days are combined development and operational testing. So to say that the formal start of IOT&E begins after the production order is correct, but there is considerable development testing going on, and there is considerable participation by the operational testers in the early stages of the combined test force. That is a normal procedure, so I did not mean to mislead you.

Senator LEVIN. I understand that. That is why I wanted to clarify this. Again, I do not know that we still have a very clear statement. The operational testing on the components will begin after the production decision is made under the current timetable?

General CROKER. With the exception that you understand, I am sure that we have already done the operational test of the full missile system.

Senator LEVIN. Of course. I am talking about on the cars.

General CROKER. Yes sir, that is correct.

Senator LEVIN. I am not talking about the test on the MX, but on the cars, which are the Rail Garrison system's change from the current configuration. The operational testing on those cars will begin, under the current timetable, after the production decision is made?

General CROKER. Yes, sir, that is correct.

Senator LEVIN. Now, we just recently received a report from the Under Secretary of Defense for Acquisition on concurrency in major weapons systems in which he stated that decisions to commit funds for low-rate initial production are supported by operational test assessments under this plan, and we will not have that operational test assessment on the cars prior to a decision to commit funds for low-rate initial production, if we follow the current timetable. Is that correct?

General CROKER. We will not have the operational test complete and the report issued.

Senator LEVIN. No, begun, General.

General CROKER. Well, sir, we will not have completely begun the testing on the entire integrated system. We have tested a number of components.

Senator LEVIN. Developmental tests?

General CROKER. Yes, sir. I am talking about operational tests on the missile, and we view this as an integration effort, not as a development effort. In other words, it is a modification to an existing system. There were two areas of technical risk, and we judged those to be very low and to have been successfully tested already.

Senator LEVIN. I understand. But, General, so we do not create any misunderstanding again, the operational testing on the two components—the two types of cars that we are talking about—those operational tests on those two components will actually not begin until after the decision on production of those cars is made under the current timetable, is that not an accurate statement?

General CROKER. That is an accurate statement.

Senator LEVIN. Okay. Now, according to the GAO—and I have to leave you in suspense on that. Thank you, General. My time is up. It is kind of a long question. It will take me a good 2 or 3 minutes.

Basically, the GAO has pointed out the unique characteristics of this program that it believes requires testing and they go into the four points. It is going to take me some time to go through them with the General, and so I will get them the next time around, because it will take me a good 3 or 4 minutes to get there.

Well, thank you. One of the points of the GAO is that a unique characteristic of the Rail Garrison program that requires testing is the capability of the train to withstand missile launch effects. E.g., the impact of ejection from the missile canister and pressures, shock and heat from the first-stage ignition.

General CROKER. As I said, we have already completed that testing. We identified that as a high technical risk at Milestone 2. We have already completed those tests.

Senator LEVIN. The operational tests?

General CROKER. Yes, sir. We have launched the shapes from the engineering model car. We have assessed the impact on the car itself and on the rail bed, and we judge those to be very low in acceptable technical risks.

Senator **Levin**. You have done this in a cold test or a hot test?

General **Croker**. Yes, sir. It is called a CALTIP—a cold launch. In other words, we take the slug and the shape and subject the car and the launcher mechanism and the rail bed to the force and impact of the launch, because as you know the missile does not light off until about 100 feet in the air.

Senator **Levin**. What about the heat?

General **Croker**. Sir, the heat will not be a factor, because it lights about 100 feet in the air.

Senator **Levin**. Do you expect to have an operational test at all with that train?

General **Croker**. Yes, sir. We are going to have five basing verification mode tests.

Senator **Levin**. Is there any reason to do that now that it has already been adequately tested?

General **Croker**. Well, I think there is some wisdom in your position that we should test the entire system.

Senator **Levin**. No, should we test the train just with a hot launch, not a cold launch?

General **Croker**. Sir, we will have five hot launches on the train between the period of the middle of 1992 to the middle of 1993.

Senator **Levin**. There is a purpose to be served in terms of reliability in those tests?

General **Croker**. Yes, sir.

Senator **Levin**. Therefore there is some risk in proceeding prior to the beginning, even of those tests?

General **Croker**. Absolutely, sir, and we judge that to be a low and acceptable technical risk.

Senator **Levin**. But there is some risk?

General **Croker**. Yes, sir. I would be misleading you if you thought there were no risks.

Senator **Levin**. It is important that we do that testing?

General **Croker**. Yes, sir.

Senator **Levin**. The next point. Have you read these four items?

General **Croker**. No, sir.

Senator **Levin**. Another unique characteristic of the Rail Garrison program that requires testing, the GAO says, is the launch effects on commercial railroad track beds.

General **Croker**. Sir, as I said, we have already tested that impact and that is negligible. The depression that we expected in the rail bed was far less than predicted. We have plans to test it in four different sub-soil structures. In other words, four different types of rail bed and we have already subjected the rail bed to the most severe loads and found the deflection of the rails acceptable and not permanent.

Senator **Levin**. The ability of the train to resume mobile operations after launch?

General **Croker**. Yes, sir. In fact, as General Chain pointed out in his testimony in the same soliloquy with you, we plan to fire a missile, move the train and fire again, and so we anticipate no problem firing and then moving the train.

Senator **Levin**. Would you tell us what five tests you are going to be doing?

General **Croker**. Sir, they are called basing verification tests. Actually, we have a test track at Vandenberg with an operational model car. In other words, it is for AFOTEC or for test purposes. It is an operational model.

Senator **Levin**. Will the tests be the same, the five tests, or is it five different tests?

General **Croker**. Sir, I am sorry, I do not have the precise details, but those five tests will test the range of situations that the rail network system is likely to experience. They will be realistic and appropriate tests. In other words, we are not shaping the tests to avoid certain areas. They should be all-encompassing.

Senator **Levin**. I would never suggest that.

General **Croker**. I know, sir.

Senator **Levin**. Thank you. My time is way past. Thank you, Senator.

Senator **Exon**. Thank you, Senator Levin. Senator Nunn?

Senator **Nunn**. Thank you, Mr. Chairman. Just a couple of questions.

Mr. Miller, I understand you have got a targeting review going on. Is that right?

Mr. **Miller**. The Secretary indicated to the House last week, last Thursday, that he had had a review underway for some time.

Senator **Nunn**. When do you expect that to be completed?

Mr. **Miller**. I said earlier, Senator Nunn, I cannot say that with any precision. We have been giving the Secretary pieces and products, and he has been sending us back to do further work and so I do not know.

Senator **Nunn**. Are we talking about a month or 6 weeks or a year? Would it be this calendar year?

Mr. **Miller**. I suspect it would be this calendar year, yes, sir, that is my guess.

Senator **Nunn**. Would it be sometime in the fall of the year?

Mr. **Miller**. Senator, I am not playing games. I just do not know. We will get back to you with the precise answer for the record, but I just do not know.

[The information follows:]

TARGETING REVIEW

The targeting review initiated by Secretary Cheney is proceeding on a phased approach. Barring any additional work stemming from the questions under review currently, we should have answers by the end of this year.

I must say, however, that our experience has shown that it is highly likely that our current efforts will raise additional questions, which will extend the completion date of this review. It will continue until the Secretary is satisfied that the review is complete.

Senator **Nunn**. Okay. My basic question is: How can we make decisions on strategic modernization, we and you, without knowing what the targeting requirements are?

Mr. **Miller**. That is a fair question. What we are doing is looking at a wide—I am trying to do this in an unclassified forum. We have been looking for some time at the kinds of requirements we would have to have under a START regime, and we have a pretty fair idea of what we can do with the 4,900 ballistic RVs in terms of deterrent requirements. The programs in front of you now would fit within the 4,900 cap. We know we are not going to have any more than the 4,900 RVs under a START Treaty. The question then really is the size of the bomber component.

In terms of programmatics we have the B-1s, the B-52Hs, and we have the cruise missile programs underway to equip the B-52Hs. So the last major element that would be new would be the B-2. And the Secretary was up here in front of you last week discussing his decision on the B-2s, his recommendations.

With regard to the mix of ballistic missile forces under the 4,900, we have not made a decision on that, and my own personal guess and observation, if you will, is that that is driven less by targeting since the D-5 and the MX are equivalent missiles in terms of accuracy, yield, CEP, that kind of situation than it is by the programmatics, by the cost, and by ultimately what comes out of the Congress on the President's program as to how we break out the 4,900 among the ICBM and the SLBM forces.

Now, in terms of predicting how targeting requirements will change, clearly we are not oblivious to the events that have taken place in Eastern Europe, and it is not clear to me. The SIOP is reviewed on an annual basis anyway. This extraordinary review that we have going may well be the kind of thing that also just continues on, that it takes chunks as things change. It is hard to predict. But what we are doing is very carefully scrubbing all of the requirements and reporting back to the Secretary. The joint staff is involved, the chairman is involved and, again, we come back with information. He sends us back to look at other areas and to do more work.

So I think we can come to you and say that the programs before you are ones that we can support, that they would not be ones that we ask you to fund now and then would have to tear up as a result of a START agreement. And the question that you have not asked me that I kind of put forward is what happens after START, and that is a fair question. I do not have an answer for you yet. We would have to come back to you with that based upon where we think we are going in a post-START Treaty, the START II, if you will, whatever follow-on treaty, and our requirements and assessments of the world at that point.

Senator Nunn. So we really have sort of an open question about the eventual shape of the strategic force structure? I mean, that is somewhat open now depending upon the review of the targeting, plus the outcome of the START talks and so forth and so on?

Mr. Miller. Well, I guess I would put it a little differently. I guess I would say that we still intend to have a triad; that the SLBM leg will be in the D-5 leg we have asked for, long lead for the 20th boat, and we think that under START we can have 20, 21 submarines plus another one or two in an overhaul exemption. We have the B-52 force, the B-1 force and the 75 B-2s that we have requested.

We will need to make some programmatic decisions on the ICBM force based upon the two programs we are discussing today and what we do with the Minuteman force.

Senator Nunn. There are a lot of things that are still pending out here. That is the point. A lot of things under review.

Mr. Miller. A lot of things are pending.

Senator NUNN. And you will be making a lot of decisions in the next 6 to 12 months?

Mr. MILLER. Yes, sir. I would not see those dramatically affecting the programs that are in the President's budget.

Senator NUNN. In a speech last month in Florida, I am told, Maj. Gen. John Robinson, JCS Director for Force Structure, Resources and Assessment—and, of course, this includes matters beyond just strategic forces—he was not referring simply to those. But he said, quoting him, "The forces that we believe are important are well understood, and we know what they will cost." Continuing the quote, "I am not at liberty this morning to give you the details, but I will tell you this: The specifics of that force, the size, its apportionment and how it is developed across the boards by department is well understood, tuned and honed in the minds of our Secretary of Defense and the Chairman of the Joint Chiefs."

Do you agree with that?

Mr. MILLER. I am surprised Dave Robinson said that, sir. I cannot speak to the conventional forces area. There are obviously a lot of changes in the world. We are about to go into a service budget review that is going to be a painful process. It is not clear to me that we are going into that with any preconceived answers, but I do not know what Dave Robinson——

Senator NUNN. Well, if you run into General Robinson over there, would you please ask him—we have been asking for the 5-year plan, force structure plan. We have been asking for a lot of things, and we know you are developing them. Would you just tell him to send us on over the apportionment, the force size, the specifics and the details that he has in his mind.

Mr. MILLER. Yes, sir. I will ask for the name of his speech writer.

Senator NUNN. Thank you. Thank you, Mr. Chairman.

Senator EXON. Chairman Nunn, are you suggesting that we need that kind of information to make rational decisions on the budget?

Senator NUNN. I am. I surely am. There is no guarantee that we will make rational decision if we had that information. [Laughter.] But it is a little more likely.

Senator EXON. We have a better chance of making rational decisions.

Senator NUNN. The odds go up.

Senator EXON. Gentlemen, there will be some questions for the record from Senator Thurmond and possibly other Senators.

Are there any other questions of the panel at this time? [No response.]

If not, we thank you very much for being here, and please respond to the written questions as promptly as you can, and we stand adjourned.

[Questions for the record with answers supplied follow:]

QUESTIONS SUBMITTED BY SENATOR SAM NUNN

PEACEKEEPER RAIL GARRISON—FAD: DEC 19, FOG: JUNE 2000

(ty$ in millions)

Senator NUNN. Please submit a revised funding profile for the Rail Garrison program that would reflect the following assumptions:

— Moratorium on obligation of fiscal year 1990 funds for construction of the RGMX base at F.E. Warren Air Force Base is lifted;

— No funding in fiscal year 1991 for procurement of any train cars;

— No fiscal year 1991 Milcon funds for any RGMX base other than F.E. Warren and Barksdale (i.e., No. 1 and No. 2 RGMX bases);

— Construction of RGMX bases No. 3-7 at rate of one per year starting in fiscal year 1992.

— Procurement of train cars to start in fiscal year 1992 or later upon full completion of operational test and evaluation of integrated MX missile/train car system (i.e., total nonconcurrency) and certification that results were satisfactory, with rate of train car procurement adjusted to match a one per year construction schedule for RGMX bases.

General CROKER. See table below:

	FY89/P	FY90	FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	TOTAL
3600	872	774	548	293	121	25	7	7	7	7	7	7	7	7	2689
3020				190	1456	653	535	453	466	579	94	97	54	22	4599
ADVACE BUY				68	66	68	53	54	56						365
WEAPON SYSTEM					1319	544	440	356	366	533	94	97	54	22	3825
INITIAL SPARES				122	71	41	42	43	44	46					409
3300	17	9	208	92	131	84	84	102	0	0	0	0	0	0	727
TOTAL	889	783	756	575	1708	762	626	562	473	586	101	104	61	29	8015
QUANTITY (TRAINS)					8	4	4	3	3	3					25

- THE ABOVE PROFILE HAS ADJUSTED THE ASSUMPTIONS TO ADDRESS RELEVANT EVENTS WHICH HAVE OCCURED SINCE THE HEARING ON 3 MAY 90.
- ASSUMES MILCON MORATORIUM EXTENDED THROUGH 15 NOV 90 (IN ACCORDANCE WITH DIRECTION FROM SECDEF).
- ASSUMES NO FUNDING IN FY91 OR FY92 FOR PROCUREMENT OF ANY TRAIN CARS.
- ASSUMES NO FY91 MILCON FUNDS FOR ANY RGMX BASE OTHER THAN F.E. WARREN AND BARKSDALE.
- ASSUMES CONSTRUCTION OF RGMX BASES #3-7 AT RATE OF ONE PER YEAR STARTING IN FY92.
- ASSUMES PRODUCTION CONTRACT AWARD IN MAR 93 FOR TRAIN CAR SYSTEMS AFTER FULL COMPLETION OF OPERATIONAL TEST AND EVALUATION OF INTEGRATED PEACEKEEPER MISSILE SYSTEM. ASSUMES ADVANCED PROCUREMENT AUTHORIZED FOR NON-TRAIN RELATED EQUIPMENT IN FY92.

TOTAL ACQUISITION COST NO. 1

Senator NUNN. What is the current estimate for the total acquisition costs (in fiscal year 1990 dollars) of completing the development of the Midgetman missile and the Hard Mobile Launcher (HML) and deploying 500 missiles in the HML basing mode at current Minuteman sites?

General CROKER. The current acquisition cost (RDT&E, Procurement and Milcon) for Small ICBM under the President's baseline program (500 UE, single RV missile, in HMLs, on Minuteman basing) is $29.5 billion (fiscal year 1990$) or a To Go Cost (fiscal year 1991 and out) of $25.8 billion (fiscal year 199O$). In Then Year dollars the total acquisition cost is $41.9 billion or a To Go Cost of $38.6 billion.

TOTAL ACQUISITION COST NO. 2

Senator NUNN. What are the life-cycle costs (in fiscal year 1990 dollars) associated with this program?

General CROKER. The 15 year life cycle cost for the baseline Small ICBM program is $33.7 billion (fiscal year 1990 $). The life cycle cost is comprised of the Total Acquisition Cost plus the Operating and Support (O&S) costs. The Total Acquisition Cost for Small ICBM includes all RDT&E, Procurement and Milcon for the President's Baseline program. The Baseline program leads to a 1997 RAA/IOC and includes up to 500 UE single reentry vehicle missile in HMLs on Minuteman basing.

DEVELOPMENT OF MIDGETMAN MISSILE NO. 1

Senator NUNN. What would be the total acquisition costs (in fiscal year 1990 dollars) of completing the development of the Midgetman missile and the AMF and deploying 500 missiles in existing Minuteman silos without procuring any HMLs?

General CROKER. The current estimated acquisition cost (RDT&E, Procurement and Milcon) for 500 single warhead Small ICBMs in Minuteman silos with a fiscal year 1992 FSD restart leading to a calendar year 1997 Required Asset Availability (RAA/IOC) is $23.7 billion (fiscal year 1990$) or a To Go Cost (fiscal year 1991 and out) of $20.0 billion (fiscal year 1990$). In Then Year dollars the total acquisition cost is estimated at $33.9 billion or a To Go Cost of $30.2 billion. This estimate does not include any additional HML work.

The cost to complete development for Small ICBM, but not procure HMLs, is approximately $1.6 billion (fiscal year 1990$) and requires 5 years from FSD restart to complete HML development.

The additional acquisition cost to later redeploy Small ICBM from silos to the HML is $12.5 billion (fiscal year 1990$). This assumes HML RDT&E is complete before redeployment begins.

DEVELOPMENT OF MIDGETMAN MISSILE NO. 2

Senator **Nunn**. What are the life-cycle costs (in fiscal year 1990 dollars) associated with this program?

General **Croker**. The 15 year cycle cost for a 500 missile silo-based Small ICBM program is estimated at $31.2 billion (fiscal year 199O$). The Life Cycle cost is comprised of the Total Acquisition Cost plus the Operating and Support (O&S) costs. The Total Acquisition Cost includes all program RDT&E (includes $1.6 billion for HML development), Procurement Milcon. This program alternative would lead to a 1997 RAA/IOC and includes 500 UE single reentry vehicle missiles in Minuteman silos.

SINGLE-RV ICBM

Senator **Nunn**. Other than its advantages for strategic stability, what is the military requirement for maintaining a single-RV ICBM in the inventory?

General **Croker**. The single-RV ICBM provides flexibility to strike and destroy targets not suited for a MIRVed ICBM. Some targets are dispersed far apart and cannot be attacked by a MIRVed ICBM or SLBM. Similarly, it would be a waste of MIRVed ICBMs to attack an isolated target that could be destroyed by a single-RV ICBM warhead. In the future, the United States will want to retain the capability of a single-RV ICBM so not to expend warheads needlessly against high priority, isolated targets. The retargeting capability of a single-RV ICBM enables it to quickly and promptly attack and destroy targets requiring only a single-RV ICBM.

Questions Submitted by Senator Strom Thurmond

SOVIET SS-25 MOBILE MISSILE

Senator **Thurmond**. Mr. Miller, the Soviet SS-25 mobile missile appears to be a most complicated system. It must be very expensive to operate. Could you please comment on this and on what this means for the importance of survivable strategic forces in the Soviet view?

Mr. **Miller**. As a general rule, mobile ICBM forces will cost more to operate than silo-based systems. While we have no Soviet figures to compare their actual cost of operations to that of planned U.S. mobile systems, I would have no reason to believe that they are not experiencing higher operating costs for their mobile systems when compared to their silo-based operations. Soviet retirements of older silo-based ICBMs may offset, in part, some of these cost increases.

Nevertheless, the Soviets have invested heavily in survivable strategic systems, including mobile ICBMs. At the moment, they are in the process of deploying two mobile systems—the rail-based, 10-RV SS-24 and the road-mobile, single-RV SS-25. The initial deployment of the road-mobile SS-25 in 1985 and the rail-mobile SS-25 in 1987 respectively, has increased significantly the survivability of their ICBM force. Currently, more than 220 road mobile ICBMs have been deployed with nearly 100 of them becoming operational last year alone. The Soviets have indicated that they plan to deploy 500 of these road-mobile missiles. We expect these mobile systems, therefore, to become an ever increasing portion of their ICBM force in the future and they have clearly indicated a willingness to make significant investments to ensure the survivability of their ICBM force.

MORALE OF SOVIET STRATEGIC FORCES

Senator **Thurmond**. Mr. Miller, we have reports that the Soviet Army is in disarray and suffering from poor morale and uncertainty. Is this true of the Strategic Rocket Forces as well?

Mr. **Miller**. I have no knowledge of the status of the overall morale of the Soviet's Strategic Rocket Forces (SRF). We have, however, seen some limited reports of

SRF officers expressing concern about recent announcements of reductions in their troop strengths. It is not likely that this apparent concern would be the cause of a widespread morale problem.

THE TYPHOON PROGRAM

Senator **Thurmond**. Mr. Miller, it has been reported in the press that the Soviets have stopped building the huge Typhoon program. Is this true, and does this mean some change in emphasis in Soviet strategic programs?

Mr. **Miller**. The number of Soviet SSBN/SLBMs are expected to consolidate into a smaller, yet more capable force over the next 10 years. The withdrawal of older SSBNs will exceed new construction resulting in a 25 to 50 percent reduction in platforms by the late 1990s. The SSBN/SLBM modernization program of the late 1970s and early 1980s involved the deployment of three new types of SSBNs—the DELTA III and IV, and the TYPHOON—and their respective SLBMs—the SS–N–18, SS–N–23, and SS–N–20. The deployment of these MIRVed SLBMs were responsible for the explosive growth of SLBM warheads from about 750 in 1975 to 3,600 by 1989. A sixth DELTA IV and the sixth and final TYPHOON joined the fleet last year. At present the DELTA IV SSBN/SS–N–23 SLBM is the only naval strategic system under construction. The Soviet may introduce a new SLBM/SSBN weapon system by the end of this decade.

As the Soviets looked ahead to START, they saw that they could deploy TYPHOONS (counting for 200 RVs each) or DELTA IVs (counting for 64 RVs each). We believe that this was a factor in their decision not to continue TYPHOON production. The decision was apparently made several years ago, and therefore, is not related directly to any recent military cutbacks. It may also have been driven by the realization that the DELTA IV/SS–N–23 combination was capable of providing nearly all the capability of the TYPHOON at a lower cost.

TRIDENT WARHEADS

Senator **Thurmond**. Mr. Miller, it has been noted in the press that DOE may not be able to supply W–88 warheads for the Trident D–5 missile. Therefore, we may be losing a significant part of the survivable hard-target capability. Does this influence the importance of the mobile missiles for U.S. strategic plans?

Mr. **Miller**. The Department of Energy (DOE) has not advised us that they cannot build sufficient warheads to meet the deployment schedule for the third D–5 submarine—the U.S.S. *West Virginia*—scheduled for completion next year. In fact, Admiral Watkins continues to believe that production can resume within the weapon production complex this summer. If so, there should be little impact to the *West Virginia's* deployment schedule with a full load of missiles and warheads.

Nevertheless, we have examined a few alternatives in order to equip deployed missiles with warheads should the facility remain in standby beyond DOE's current estate. Projections of the outage will determine our course of action. For example, if Rocky Flats is projected to open after a 6-month delay, it is likely that we would deploy the *West Wirginia* with a partial load of warheads. When supply (production within the complex) catches up with demand, we would back-fill the warhead spaces. If the outage is projected for an extended period, the only feasible alternative would be to redistribute newer Poseideon C–4 warheads in the fleet—either by downloading operational C–4 missiles, or by retiring C–4 capable Poseidons earlier than currently planned.

Each of these alternatives is highly undesirable from a policy and capabilities standpoint. Although each solution is preferable to simply not deploying new construction Trident submarines, neither can serve as a substitute for reopening the plant at Rocky Flats.

The deployment of the D–5 with Mk 5s provides a survivable and enduring hard target capability which significantly increases the flexibility of the SLBM force. That capability enables the sea-based leg of the Triad to strike effectively—for the first time—virtually the full spectrum of installations in the target system. In turn, a fully-deployed D–5/Mk 5 force will afford the United States the capability to hold at risk Soviet assets with a smaller, more efficient and cost effective SSBN force.

STRATEGIC TARGETS

Senator **Thurmond**. Mr. Miller, it has been noted that a number of strategic targets in Eastern Europe could well be removed from the SIOP. But does this mean a change in the number of weapons needed? Won't most of those Soviet forces, if not all, still be strategic targets if they move back to the Soviet Union?

Mr. MILLER. All of our nuclear plans are designed to be highly flexible in order to accommodate a large number of circumstances and scenarios, which offer the President a wide variety of options. All the plans, including the SIOP, are reviewed and revised regularly by senior military and civilian officials with the Department, including the Chairman and the Secretary.

In addition to this normal review, Secretary Cheney indicated in his 26 April testimony on the Major Aircraft Review that we will undertake a special review to examine all of the targeting requirements, which will include factors such as the changes in the status of Soviet forces deployed in the Warsaw Pact.

SURVIVABILITY OF RAIL GARRISON

Senator THURMOND. General Croker, some people have maintained that, because the Rail Garrison is kept in garrison until strategic warning, it is therefore not survivable. Is SAC going to have to wait until Soviet missiles are in the air before he can order the trains to disperse?

General CROKER. The Peacekeeper Rail Garrison system will be able to survive when ordered to disperse at the direction of the National Command Authority or CINCSAC. The decision to disperse the Peacekeeper Rail Garrison system is scenario dependent. However, the National Command Authority or CINCSAC would not degrade the capability of Peacekeeper Rail Garrison if they felt its survivability was at stake. Similarly, it is likely the National Command Authority or CINCSAC would disperse Peacekeeper from garrisons at the same time bombers were being generated and relocated to their dispersal bases. This implies the United States would have sufficient warning time to ensure its strategic forces could survive and operate. It is highly unlikely the Soviets would initiate a nuclear attack on the United States without adequate warning time since the outcome could not ensure the Soviets victory.

PROGRAM COST COMPARISONS

Senator THURMOND. How do the costs of the mobile ICBM programs compare to say, Trident? Please address both acquisition and operating costs.

Mr. MILLER. It is extremely difficult, if not impossible, to make a fair cost comparison among the Peacekeeper Rail Garrison (PKRG), Small ICBM (SICBM), and Trident programs. Such cost comparisons are based on a host of assumptions that are critical to the correct interpretation of the results. Moreover, there is no single best way to make comparisons of such diverse programs.

The three programs are at different stages of acquisition maturity. For some purposes it may be important to distinguish between total acquisition cost and cost to go. The SICBM is in the early stages of development, while Peacekeeper missiles are already deployed in silos and would only need to be rebased to complete acquisition for the PKRG program. All of the Trident submarines have been procured but the D–5 missiles for those submarines will continue. The SICBM would, therefore, compare less unfavorably to the other systems on a cost to go basis.

The three programs differ significantly in the total number of warheads. As such, comparisons of total program costs must be viewed in this light. The PKRG deployment would consist of 500 warheads on 50 missiles; the number of SICBMs is still uncertain, although 500 is one option. A Trident force of 18 SSBNs, each with 24 missiles—a contribution of about 3,500 warheads. Total acquisition cost for Trident is significantly greater than that for SICBM or PKRG; but Trident program is larger and costs should be higher.

The costs for dissimilar programs are often compared on a cost per warhead basis to eliminate the misleading effects of quantity on the results. Even this seemingly straightforward approach has its problems also. The total cost used in the basis of this calculation may be total system cost or cost to go and may or may not include operations and support costs. The results are thus highly variable, but on any per warhead basis, Trident is less expensive than either of the two mobile ICBM systems, and SICBM is more expensive than PKRG. A MIRVed missile—either an ICBM or SLBM—is, of course, less expensive on a per warhead basis to procure and maintain than a single-warhead missile. The PKRG, with only 50 deployed missiles, is taxed with a greater per warhead cost for development and test missiles than a 432 deployed missile Trident program or a 500-missile SICBM force.

Operations and support (O&S) costs tend to follow the same patterns as the acquisition costs. Annual Trident O&S costs are highest; PKRG costs are the lowest. On a cost per warhead basis, however, Trident O&S costs are the lowest, but not significantly lower than those of PKRG and SICBM costs are the highest. The costs for Small ICBM would also depend on the choice of basing; since neither PKRG or

SICBM is near deployment, O&S estimates contain some uncertainties, especially for SICBM.

Other asymmetries in the programs only add to the difficulties of making meaningful cost comparisons. For example, the Trident SSBN is projected to have a 40-year lifetime, while ballistic programs are designed generally for a 15-year life. Each system has its own strengths and weaknesses and makes a unique contribution to the U.S. strategic deterrent. These factors are not reflected in any comparison based strictly on cost or even cost per warhead.

[Whereupon, at 3:57 p.m., the subcommittee adjourned, subject to the call of the Chair.]

DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEAR 1991

WEDNESDAY, MAY 9, 1990

U.S. SENATE,
SUBCOMMITTEE ON STRATEGIC FORCES
AND NUCLEAR DETERRENCE,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

TRIDENT MISSILE AND SUBMARINE PROGRAMS

The subcommittee met in closed session, pursuant to notice, at 2:02 pm., in room SR–222, Russell Senate Office Building, Senator J. James Exon (chairman of the subcommittee) presiding.

Committee members present: Senators Exon, Levin, Wirth, Thurmond, Wallop, and Gorton.

Committee staff member present: Madelyn R. Creedon, counsel.

Professional staff members present: Robert G. Bell, Creighton Greene, William E. Hoehn, Jr., and T. Kirk McConnell.

Minority staff members present: Brian D. Dailey, George W. Lauffer, John E. Mansfield, Mark B. Robinson, and Ann Elise Sauer, professional staff members.

Staff assistants present: Lori M. Jackson, Lisa H. Kettlewell, and Mickie Jan Wise.

Committee members' assistants present: Andrew W. Johnson, assistant to Senator Exon; Kenneth N. Luongo, assistant to Senator Levin; William J. Lynn, assistant to Senator Kennedy; Terence M. Lynch, assistant to Senator Shelby; Anthony H. Cordesman, assistant to Senator McCain; Lee E. Whittaker, assistant to Senator Wallop; Thomas G. Moore, assistant to Senator Wallop; Robert M. Soofer, assistant to Senator Gorton; Charles G. Pearcy, assistant to Senator Lott; and Eric H. Thoemmes, assistant to Senator Coats.

OPENING STATEMENT OF SENATOR J. JAMES EXON, CHAIRMAN

Senator EXON. The subcommittee will please come to order. I would ask the staff to make certain that the room is properly cleared. We are in closed session today.

The Strategic Forces and Nuclear Deterrence Subcommittee meets this afternoon in closed session to review the Trident submarine and the missile programs connected therewith. The Trident submarine and missile programs have been, by all accounts, highly successful and certainly are well managed.

This success is doubly fortunate, for Trident is both very expensive and a critical component of our strategic deterrent. In the view of this one Senator at least, it is the most important part of our nuclear deterrent. This importance is underscored by the continuing uncertainties in and disagreements over the future of the ICBM and the bomber leg of our strategic triad—a discussion that is going full-fledged and unabated in these halls today.

At the same time, severe budget pressures are forcing us to find economies wherever we can. Without a full discussion, without the testimony that we are receiving, such as from you gentlemen here today, we cannot begin to make the critical decisions that are going to be uppermost in our minds, those of us who have the opportunity to serve on the authorizing committees.

With only a few more Tridents left to be procured, it is reasonable to reconsider the merits of continuing to procure one submarine each and every year, as has been our policy. Buying the few remaining submarines at a rate of one every 2 years or two every 3 years must be considered at least as a way to preserve a stable submarine industrial base, to retain the production base as a hedge against an arms control breakout, and to conserve scarce resources. We will be examining this issue in greater detail this afternoon.

In last year's authorization act, the Congress required a report on Trident SLBM reentry vehicle downloading. We required this study and report to gain insight on how we might structure our ballistic missile forces under a START Treaty limiting missile warheads to 4,900 on each side.

Removing a few RVs from each Trident II missile would have a number of benefits. For one, we could deploy the currently-planned number of Trident submarines without tripling the ICBM force. For another, fewer RVs per SLBM would increase the range of each missile and thereby increase the patrol areas and hence the survivability of our deployed submarines.

As it turns out, we were more prescient in requesting this report than anyone could have imagined given what has happened in the meantime. Due to a prolonged shutdown of the Department of Energy's Rocky Flats plant, [deleted]. Moreover, according to recent news accounts, the Soviets have suggested that START II negotiations should address reducing the number of RVs on individual SLBMs.

While the committee's request for a report on downloading was timely, the Navy's response was not. The report was due on March 15. Today is the 9th of May, according to all reasonable accounts, nearly 2 months beyond the date that we had expected the report. Still we have no report. We will seek an explanation from our witnesses today for this delay.

The subcommittee requested testimony from the Navy this afternoon from Vice Adm. Dan Cooper, Assistant Chief of Naval Operations for Undersea Warfare and from Rear Adm. Kenneth Malley, Director of the Strategic Systems Program Office. We are pleased that you gentlemen could join us today.

Subsequently, the Office of the Under Secretary of Defense for Policy requested that we permit an official from that organization to attend today's hearing as well, and of course we are always very pleased to see J.D. Crouch back with us again, where he spent so many, many hours with us working on national security matters.

I want to welcome you and of course we are very pleased that a former very important staff member is now in a particularly important role as the Principal Deputy Assistant to the Secretary of Defense for International Security Policy. We know well that you understand the concerns that we have here and you bring with you today a perspective now from the Navy that is very important to us.

Dr. Crouch, of course, until recently served as Senator Wallop's staff representative to the Armed Services Committee. We will have some arms control questions to pose to Dr. Crouch when we get into the question and answer session.

Senator Strom Thurmond, my distinguished colleague and ranking member, will be along very shortly and at that time, when it is convenient, I will interrupt the questioning so that Senator Thurmond might give his opening remarks, which I believe he will have.

[The prepared statement of Senator Thurmond follows:]

PREPARED STATEMENT OF SENATOR STROM THURMOND

Mr. Chairman, I am happy to welcome Admiral Cooper, Dr. Crouch, and Admiral Malley to testify before the subcommittee on the status of our submarine launched ballistic missile program. The subcommittee has supported these programs in the past because of the need to ensure that the United States continues to have the benefit of a strong and survivable deterrent triad into the 21st century. Today's testimony will be an important factor in our discussion and deliberation on the President's Strategic Modernization Program. I hope today we will be able to put in the record the answers to troubling questions on this program.

Mr. Chairman, I am concerned that the notion of an independently survivable Triad of strategic forces is being questioned. The assumption seems to be that tensions between the United States and the Soviet Union have been reduced so we no longer need to maintain the Triad, but can let one or another leg of the Triad wither away.

I reject that assumption. Such a view is based on a perception of Soviet *intentions*, which may or may not have changed. However, the survival of our deterrent depends on Soviet *capabilities*, which have *not* changed. The Soviets have a rapid, accurate hard target capability against ICBM silos. The Soviets have capable ABM system. The Soviets have the most complete bomber defense capability the world has ever seen. The Soviets continue to spend vast sums on detecting missile submarines. In short, there is no leg of the Triad that is *guaranteed* to be secure and survivable. So we must retain and modernize the Triad.

Mr. Chairman, we all recognize how successful the Trident program has been. Nevertheless there are troubling developments and difficult issues to face, such as:

— How many boats should we buy?
— What will the effect of START be?
— Will DOE be able to supply W-88 warheads on time?

I hope the witnesses will address these concerns, and I look forward to their testimony.

Senator **Exon**. Before we begin, though, can the staff assure me at this time that the room has been properly secured? I understand it has been.

I would ask our witnesses whether all those present in the hearing room that came with you are appropriately cleared for this session.

Admiral **Cooper**. Yes, sir, that is correct.

Senator **Exon**. Thank you. We have no particular order, so we will proceed with Dr. Crouch. Would you like to be the lead-off man today? If so, I am pleased to recognize you at this time.

STATEMENT OF DR. J.D. CROUCH, PRINCIPAL DEPUTY ASSISTANT SECRETARY OF DEFENSE (INTERNATIONAL SECURITY POLICY)

Dr. Crouch. Good afternoon, Mr. Chairman and distinguished members of the committee. It is a welcome opportunity and great pleasure to be back here at the Armed Services Committee to review the subject of the modernization of our strategic submarine program.

The U.S. strategic submarine program has played an integral role in the deterrence of nuclear war since our Nation's first SSBN, the U.S.S. *George Washington,* deployed to sea with Polaris missiles in November 1960. Since that time, the United States has successfully fielded five different SLBM types as well as three classes of submarines.

The United States is currently deploying the new generation D-5 missile in new construction Trident submarines. With each new submarine and missile we have improved our strategic submarine capabilities significantly. We have extended the range of our missiles from 1,200 nautical miles with the old A-1 missile on the Polaris to over 4,000 nautical miles with the D-5, thus expanding the available patrol area for strategic submarines from some 400,000 square nautical miles to approximately 17 million square nautical miles.

We have also consistently improved the accuracy of our missiles, submarine quieting technologies, communications links, and at-sea rates with each new generation of fleet ballistic missile systems. Today we are confident that with the introduction of the Trident II system we will have a more survivable, secure and capable submarine force than at any other point in the 30-year history of the program.

The improvements we have made over the years have been and will continue to be critical to our ability to maintain a stable, flexible and robust nuclear deterrent well into the next century.

In fact, the entire U.S. strategic modernization program is premised on the fundamental assumption that nuclear forces will continue to play a central role in the security postures of the United States and the Soviet Union for the foreseeable future. The dramatic change we have witnessed in the Soviet Union over the past 5 years does not undercut this assumption.

On the contrary, patterns of change unfolding in the Soviet Union reinforce our perceptions of the continuing presence and need for nuclear forces well into the 21st century.

As the Soviet Union attempts to alter its economy and its conventional military force posture in Europe, strategic nuclear forces will grow in relative importance to the Soviets. With significantly diminished conventional forces, anticipated withdrawal of Soviet forces from Eastern Europe, and the essential dissolution of the Warsaw Pact and the disarray of the Soviet economy, Soviet strategic forces are quickly becoming the sole guarantor of Soviet superpower status.

The Soviet Union is not likely to relinquish this status. Soviet intentions to maintain a formidable strategic arsenal are borne out in the ongoing Soviet strategic modernization program. The Soviet

Union continues to deploy new and modern SSBNs, three types of bombers and three types of ICBMs, two in mobile variants.

While we debate Peacekeeper Rail Garrison deployment, the Soviets continue deployment of the rail-mobile SS–24 with its 10 warheads. While we debate research on the Small ICBM, the Soviets are deploying hundreds of SS–25 mobile missiles. While we debate initial production of the B–2, the Soviets continue to build Blackjack, Backfire and Bear-H bombers.

Moreover, recent events in Eastern Europe and the Soviet Union should serve to remind us of the rapid and unpredictable nature with which political circumstances and intentions can change. Military capabilities, however, are far less transitory. As long as the Soviets maintain a significant nuclear capability, we believe it is essential to continue a strong, credible U.S. nuclear deterrent.

The Trident program we are talking about today represents the centerpiece of our SSBN modernization. This year the President is requesting funding for procurement of the 18th Trident submarine. All reasonable post-START force structures that we have considered contain at least this many submarines, plus an additional two to three in overhaul.

We have agreed in principle with the Soviets, I would add, to exempt a certain number of launchers on submarines in overhaul from accountability in START, and I believe it would be prudent to take advantage of this important provision. START in fact can accommodate a range of possible post-START SSBN force structures.

In this context, it is important to note that START does not place direct restrictions on the number of deployed SSBNs. The focus instead of START is limiting deployed nuclear weapons, with each side being allowed 4,900 ballistic missile warheads. The 4,900 sublimit restricts SSBN force levels indirectly, based on the number of accountable warheads on each submarine.

The Defense Department will define the remaining START force structure parameters when it feels confident that U.S. negotiating objectives will not be undermined by premature commitment to a hypothetical post-START force structure.

In any event, the force structure we choose will not cause us to scrap any of the Trident SSBNs now in construction or the submarines being requested in the President's fiscal year 1991 budget. We do not intend to request funding for any Trident SSBNs above the levels which we could accommodate under a START agreement.

The adequacy, looking to the future, of the prospective size of the U.S. SSBN force depends upon the nature of any future Soviet ASW threat. Today, U.S. SSBNs, both the Poseidon and the Trident, are virtually invulnerable once deployed to the open ocean.

As a hedge against unanticipated Soviet advances in the future, the Trident SSBN was designed to be and is substantially quieter than Poseidon and operates in a greatly-expanded patrol area. It is this greater survivability of the Trident SSBN, together with cost considerations, that allowed the Navy to concentrate a greater number of SLBMs on each fleet ballistic missile submarine and plan for a reduced number of SSBNs, down from the current level of 34.

Part of our Trident modernization plan also calls for the backfit of the D–5 missile into the first eight Trident submarines which are currently carrying the C–4 missile. Moving to an all D–5 force has important deterrent and military advantages.

Due to its increased potential range, the D–5 missile will enhance our SSBN survivability by providing greater operational patrol area and full target coverage of the Soviet Union from both oceans. In addition, the move to a single missile support infrastructure provides the added benefit of reducing overall SLBM life cycle costs. Backfits are scheduled to begin in fiscal year 1993 and continue at a rate of one per year until each of the first eight Trident boats has been fit with D–5.

As the introduction of new construction Trident submarines continues, we are concurrently retiring aging Poseidon submarines which have reached the end of their useful service lives. We currently procure one submarine each year and thus are able to introduce one submarine annually into the force.

In March 1990, the U.S.S. *Tennessee*, our first D–5-capable Trident, deployed out on its first patrol. The *Tennessee* is our ninth Trident submarine to enter the fleet. During the next fiscal year, the U.S.S. *Pennsylvania* will deploy out on its first patrol.

We feel it is important to maintain our current procurement rate of one SSBN annually. Given the concurrent retirement of Poseidon SSBNs, to include 11 with C–3 missiles by 1996 and 12 with C–4 missiles by 1999, SLBM RVs at sea will decline to levels well below our current level by 1999.

A slower Trident procurement rate would exacerbate the loss of capability that our SSBN force will suffer during the additional years we would be required to wait for completion of the Trident force and the resultant increase in the number of deployed SLBM warheads.

Trident construction requires a long lead time of 7 years. Boats authorized and appropriated in fiscal year 1991 will not be ready for deployment until 1998. U.S. warheads based at sea represent our most survivable systems under all conditions of warning. Continuity of target coverage, as well as strategic stability considerations, dictate that we modernize our SLBM forces as early as possible.

I would add—and I think this is an important point—as we plan the budget in the future, stretching the Trident procurement program does increase the unit cost of each SSBN.

In closing, Mr. Chairman, I would like to reaffirm this administration's commitment to strategic modernization. Trident represents a central facet of this program and will continue to receive the strongest support from the Department of Defense. The Trident program has been truly exemplary, contributing significantly to this country's deterrent capability through its inherent flexibility and survivability.

We are hopeful that Congress will continue to provide strong support for the Trident program as well. We are very grateful for the support that this committee has shown the Trident program in the past.

Thank you, Mr. Chairman and other members of the committee, for inviting me here today, and I yield the floor to you. I guess maybe Admiral Cooper will be going next.

[The prepared statement of Dr. Crouch follows:]

STATEMENT OF
DR. J.D. CROUCH
PRINCIPAL DEPUTY ASSISTANT SECRETARY OF DEFENSE
(INTERNATIONAL SECURITY POLICY)

Good afternoon, Mr. Chairman and distinguished members of the Committee. I welcome this opportunity to address the subject of the modernization of our strategic submarine program today. The US strategic submarine program has played an integral role in the deterrence of nuclear war since our nation's first SSBN, the USS George Washington, deployed to sea with Polaris missiles in November 1960. Since that time, the US has successfully fielded five different SLBM missile types, the A-1, A-2, A-3, C-3, and the C-4, as well as three classes of submarines. The US is currently deploying the new generation D-5 missile in new construction Trident submarines.

With each new submarine and missile, we have improved our strategic submarine capabilities significantly: we have extended the range of our missiles from 1,200 NM with the A-1 missile, to over 4,000 NM with the D-5 missile, thus expanding the available patrol area for strategic submarines from 400,000 square NM to approximately 17 million square NM today. We have also consistently improved the accuracy of our missiles, submarine quieting technologies, communications links, and at-sea rates with each new generation of fleet ballistic missile systems. Today we are confident that, with the introduction of the Trident II system, we will have a more survivable, secure, and capable submarine force than at any other point in the thirty year history of the program.

The improvements we have made over the years have been, and will continue to be, critical to our ability to maintain a stable, flexible, and robust nuclear deterrent well into the next century. In fact, the entire US strategic modernization program is premised on the fundamental assumption that nuclear forces will continue to play a central role in the security postures of the US and Soviet Union for the foreseeable future.

The dramatic change we have witnessed in the Soviet Union over the past five years does not undercut this assumption. On the contrary, patterns of change unfolding in the Soviet Union reinforce our perceptions of the continuing presence and need for nuclear forces well into the next century. As the Soviet Union attempts to alter fundamentally its mode of government, its economy, and its conventional military force posture in Europe, strategic nuclear forces will grow in relative importance to the Soviets. With significantly diminished conventional forces, anticipated withdrawal of Soviet forces from Eastern Europe, essential dissolution of the Warsaw Pact, and the disarray of the Soviet economy, Soviet strategic forces are quickly becoming the sole guarantor of Soviet superpower status. The Soviet Union is not likely to relinquish this status willingly.

Soviet intentions to maintain a formidable strategic arsenal are borne out in the ongoing Soviet strategic modernization program: despite peaceful rhetoric, the Soviet Union continues to deploy new and modern SSBNs (Delta IV), three types of bombers (Blackjack, Backfire, and Bear H), and three types of ICBMs (SS-18 Mod 5, SS-24, and SS-25), two in mobile variants. While we debate Peacekeeper Rail Garrison development, the Soviets continue deployment of the rail mobile SS-24 with its ten warheads. While we debate research on the Small ICBM, the Soviets are deploying hundreds of SS-25 road mobile missiles. While we debate initial production of the B-2, the Soviets continue to build Blackjack, Backfire and Bear H bombers. While we debate research toward the deployment of an effective defense, the Soviets continue to spend as much on strategic defense as they do on strategic offense.

Moreover, recent events in Eastern Europe and the Soviet Union should also serve to remind us of the rapid, and unpredictable nature with which political circumstances and intentions can change. Military capabilities, however, are less transitory. As long as the Soviets maintain a significant nuclear capability, we believe it essential to continue a strong, credible US nuclear deterrent.

The Trident program represents the centerpiece of SSBN modernization. This year, the President is requesting funding for procurement of the 18th Trident submarine. All reasonable post-START forces that we have considered contain at least this many submarines, plus an additional two to three in overhaul. We have agreed in principle with the Soviets to exempt a certain number of launchers on submarines in overhaul from accountability in START and would be foolish not to take advantage of this important provision.

START in fact can accommodate a range of possible post-START SSBN force structures: it is important to note that START does not place direct restrictions on the number of deployed SSBNs. In theory, the US could deploy an unlimited number of SSBNs. The focus of START is in limiting deployed nuclear weapons with each side being allowed 4,900 ballistic missile warheads. The 4,900 sublimit restricts SSBN force levels indirectly based on the number of accountable warheads on each submarine. The Defense Department will define the remaining START force structure parameters when it feels confident that US negotiating objectives will not be undermined by premature commitment to a hypothetical post-START force structure. In any event, the force structure we choose will not cause us to scrap any of the Trident SSBNs now in construction, or the submarines being requested in the President's FY 91 budget. We do not intend to request funding for any Trident SSBNs above the levels which we could accommodate under a START agreement.

The adequacy of the prospective size of the US SSBN force depends upon the nature of any future Soviet ASW threat. Today, US SSBNs -- both Poseidon and Trident -- are virtually invulnerable once deployed to the open ocean. As a hedge against any unanticipated Soviet advances in the future, the Trident SSBN was designed to be -- and is -- substantially quieter than Poseidon and operates in a greatly expanded patrol area. It is this greater survivability of the Trident SSBN, together with cost considerations, that prompted the Navy to concentrate a greater number of SLBMs on each unit (24 rather than the traditional 16) and plan for a reduced number of SSBNs down from the current level of 34.

Part of our Trident modernization plan also calls for the backfit of the D-5 missile into the first eight Trident submarines which are currently carrying the C-4 missile. Moving to an all D-5 force has important deterrent and military advantages: due to its increased potential range, the D-5 missile will enhance our SSBN survivability by providing greater operational patrol area, and full target coverage of the Soviet Union from both oceans. In addition, the move to a single missile support infrastructure provides the added benefit of reducing overall SLBM life cycle costs. Backfits are scheduled to begin in FY 93 and continue at the rate of one per year until each of the first eight Trident boats have been fit with D-5s in FY 01.

As the introduction of new construction Trident submarines continues, we are concurrently retiring aging Poseidon submarines which have reached the end of their useful service lives. We currently procure one submarine each year, and thus are able to introduce one submarine annually into the force. In March 1990 the USS Tennessee, our first D-5 capable Trident, deployed out on its first patrol. The Tennessee is our ninth Trident submarine to enter the fleet. During the next fiscal year, the USS Pennsylvania will deploy out on its first patrol.

We feel it is important to maintain our current procurement rate of one SSBN annually. Given the concurrent retirement of Poseidon SSBNs (11 C-3 boats by 1996, and 12 C-4 boats by 1999), SLBM RVs at sea will decline to levels well below our current level by 1999. A slower Trident procurement rate would exacerbate the loss of capability that our SSBN force will suffer during the additional years we would be required to wait for completion of the Trident force, and an increase in the number of deployed SLBM warheads. Trident construction requires a long lead time of seven years. Boats authorized and appropriated in FY 91 will not be ready for deployment until 1998. US warheads based at sea represent our most survivable systems under all conditions of warning. Continuity of target coverage, as well as strategic stability considerations, dictate that we modernize our SLBM force as early as possible. Additionally, stretching the Trident procurement program increases the unit cost of each SSBN. At a rate of one ship every two years each Trident procured after FY 91 would cost $180 M more, cost of the FY 91 hull would increase by $90 M, and costs associated with all FY 90 SSNs and SSBNs constructed at General Dynamic's Electric Boat Division would increase by $50 M.

In closing, I would like to reaffirm this Administration's commitment to strategic modernization. Trident represents a central facet of this program and will continue to receive the strongest support from the Department of Defense. The Trident program has been truly exemplary, contributing significantly to this country's deterrent capability through its inherent endurability, flexibility, and survivability. We are hopeful that Congress will continue to provide strong support for the Trident program as well.

Thank you, Mr. Chairman and members of the Committee for inviting me here today.

Senator EXON. Thank you very much. We will proceed now to you, Admiral Cooper. If you have extended statements for the record, they will be accepted and be made part of the record at this time, without objection, and if you would please summarize at this time we would be pleased to recognize you, Admiral.

STATEMENT OF VICE ADM. D. L. COOPER, USN, ASSISTANT CHIEF OF NAVAL OPERATIONS (UNDERSEA WARFARE); ACCOMPANIED BY REAR ADM. KENNETH C. MALLEY, USN, DIRECTOR, STRATEGIC SYSTEMS PROGRAM OFFICE

Admiral COOPER. Thank you, Mr. Chairman. I appreciate the chance to be here to discuss the submarine force. I do have a few points I would like to make, and I appreciate having my statement inserted in the record.

In contrast to the dramatic changes in the conventional forces that we have seen the Soviet Union undertake, we have seen absolutely nothing that would indicate they are going to decrease either their strategic forces in total or their submarine forces. So I, as ACNO for Undersea Warfare, am very concerned about that particular aspect as we look at the world today.

Despite the world changes, it is my strong opinion the United States has to maintain a credible strategic deterrent. Fulfilling this requirement, our strategic submarines—and I am slightly biased—are a keystone to the national strategic posture. The Trident submarine modernization is in progress now, and it has been proven. The D-5 missile has been tested and it is, in fact, operational at sea now.

The SLBMs, as you look at them with the Trident submarine, are in fact the most cost-effective leg. The old triad bias which we have had over the years, when we talked about what are the strong facets of each one of the legs of the triad, has changed. We used to say that the communications to the submarines were poor and we used to say that the accuracy of the SLBM was, in fact, poor. That has changed.

The SLBM, with the introduction of the Trident D-5 missile, is in fact as accurate as any other missile in the world today. We can address the entire target spectrum with the D-5 missile. And connectivity has improved through lots of work that we have done. Right now in connectivity, over the last 10 years we have proven that [deleted] any message will get through to our Tridents on patrol.

We have an SSBN security program to look and see if there is any vulnerability out there to make us detectable, to impact on the survivability of our Trident submarines. We have measured scientific measurements and we do a continuous evaluation of the threat technologies that we see the Soviets working on.

As a result, every year the [deleted] comes out with a paragraph that says—and this is what it has said this year—"No scientifically plausible prospect for an ASW technology breakthrough which would provide a basis for threatening attack on our SSBNs through the 1990s and beyond has been seen."

In my opinion, the requirement is clearly defined. All reasonable post-START forces, as Dr. Crouch has said, account for at least the 20 to 21 Tridents, 18 operational and 2 or 3 in overhaul. There is no programmatic basis today to delay this year's Trident, the 18th that we are asking for. There is no programmatic basis.

The D-5 missile issues have been solved. The D-5 is on patrol. The warhead issue with Rocky Flats does not impact the 18th Trident submarine. That will be solved long before that comes out in 5 to 7 years. And the START issues have all been addressed in accordance with DOD.

The strategic submarine force unquestionably is the cornerstone of our strategic deterrent. The ongoing modernization is absolutely vital to our national security, and it warrants your full support.

I appreciate it. Thank you for the chance to be with you.

[The prepared statement of Admiral Cooper follows:]

STATEMENT OF
VICE ADMIRAL D. L. COOPER, U.S. NAVY
ASSISTANT CHIEF OF NAVAL OPERATIONS
(UNDERSEA WARFARE)

Mr. Chairman and distinguished members of the Committee, I am privileged to report to you the status of the Strategic Submarine Force.

The goal of the U.S. strategic deterrent forces (TRIAD) is to deter adversaries from committing aggression. This is best assured by reliable, capable, and responsive strategic forces with sustained survivability. **Strategic submarines (SSBNs) possess all these necessary attributes which, combined with the invulnerability of the SSBN force, result in a viable and survivable stabilizing strategic deterrent that is a keystone of our national strategic posture.**

In contrast to the dramatic changes taking place in the Warsaw Pact and Soviet conventional air and ground forces, Soviet modernization of its strategic nuclear forces is continuing unabated. CIA Director Webster recently concluded that the bulk of the evidence about the Soviet strategic forces and programs show a vigorous, broad-based modernization effort that is improving their overall strategic capabilities. Ongoing Soviet deployment programs include three intercontinental ballistic missiles (ICBMs), two of which are mobile, two nuclear-powered ballistic missile submarines armed with new types of MIRVed submarine-launched ballistic missiles (SLBMs), and two new strategic bombers. **Even with the economic crises affecting the Soviet Union, the modernization of Soviet strategic forces remains relatively unimpaired. The Soviet strategic program continues to represent the paramount threat to U.S. national security.**

In response to this threat, the fundamental requirement for the United States strategic submarine force is the maintenance of a credible deterrent vis-a-vis the Soviet Union to protect our

interests and those of our allies. When measured against the criteria of ensuring our nation's deterrent flexibility and maintaining our defense options versus modernized Soviet capabilities, the invulnerability of our strategic submarines provides a stabilizing deterrent which is the best possible insurance. Our newest class of missile-carrying submarine is continuing a very successful strategic modernization program, the TRIDENT II (D-5) missile program. This program is reaching maturity at precisely the right time in our nation's history; it will enable us to safely weather the period of strategic and defense uncertainly which lies ahead. The TRIDENT II (D-5) missile, with its improved accuracy, greater range, and larger payload, allows the seagoing portion of our TRIAD, for the first time, to engage the full spectrum of targets.

Strategic submarines, with SLBMs, provide the most cost-effective deterrent to nuclear war. These submarines carry almost 50 percent of the strategic warheads in our country's inventory for only about 25 percent of the Department of Defense's strategic budget. These costs represent about ten percent of the Navy's total budget and support all aspects of the strategic submarine program including operation, maintenance, training, support, procurement, and modernization. This cost-effectiveness results from small crew-size, high ship operating tempo, and proven reliability of the submarine and missile systems.

The strategic submarine force is controlled through a reliable, redundant, continuous and reconstitutable communication system. Comprehensive evaluations of each SSBN patrol by an independent agency have shown that SSBN's communications connectivity with the National Command Authority is greater than ninety-nine percent. The introduction of the new E6A TACAMO aircraft, the Extremely Low Frequency (ELF) broadcast system, communication station upgrades and improvements to the TRIDENT radio room have strengthened our already sound communications program and will ensure future reliability. Our communications program promotes crisis stability by assuring that National Command Authority orders can be delivered before, during, or after a nuclear attack on the United States.

The strategic submarine force's overall capability and firepower are exceptional. Eight OHIO Class TRIDENT submarines are making routine patrols from Bangor, Washington. They have completed over 140 deterrent patrols. **In March 1990, the USS TENNESSEE (SSBN-734) became the first TRIDENT II (D-5) missile-capable ship to deploy from the new operating base at King's Bay, Georgia.** There are currently eleven Poseidon (C-3) missile submarines and twelve TRIDENT I (C-4) backfit submarines making patrols in the Atlantic. The entire SSBN force has completed more than 2,800 strategic deterrent patrols since the USS GEORGE WASHINGTON (SSBN-598) first deployed in November 1960, a tremendous success story for deterrence.

Seven TRIDENT II (D-5) capable submarines are presently under construction. The President's budget is requesting funding for the procurement of the 18th TRIDENT submarine and advanced procurement for the 19th and 20th. These TRIDENT submarines will replace aging Poseidon and TRIDENT I backfit submarines when they reach mandatory retirement toward the end of this decade. The eight Pacific Fleet TRIDENT I capable submarines will also be modernized with the TRIDENT II (D-5) starting with the USS OHIO as she enters her first overhaul period in 1993. Moving to an all D-5 force has important advantages. The increased range and more potent warhead not only adds targeting flexibility, but enhances SSBN survivability by expanding the operational patrol areas for the TRIDENT submarine. Logistic support will also become more cost-efficient by having a common missile. This effort, combined with the continued TRIDENT submarine new construction program, will result in the complete modernization of the strategic submarine force. **Our goal of 21 operational TRIDENT submarines, with two or three TRIDENTs in**

overhaul, is consistent with our START negotiations where we have agreed in principal with the Soviets to exempt submarines in overhaul from accountability in START. This most important and highly successful program deserves your strong continued support.

We ensure the survivability of the strategic submarine with the SSBN Security Program. This program, based on detailed and systematic scientific measurement, continuously evaluates emerging threat technologies to prevent vulnerability from technological surprise. Key elements of the program are all-source idea solicitation, leading-edge technology research and exhaustive at-sea testing. All-source idea solicitation includes foreign exchange programs and intelligence agency inputs. Broad agency announcements open channels for academia and industry to examine innovative ideas. The most knowledgeable engineers and scientists in the country conduct thorough and systematic research to resolve technical uncertainty and, where necessary, develop countermeasures against potential technological threats. Tactics are also developed to ensure future survivability of our first-line strategic deterrent.

Program results are critically reviewed. Among the groups who periodically evaluate the program are the Advanced Technology Panel to the CNO's Executive Board, the Defense Science Board, the CIA, which has been directed by Congress to independently assess the threat from detection technology developments, and an independent evaluation by the JASONs, scientists drawn from academia. Independent conclusions consistently agree: There is **no scientifically plausible prospect for an ASW technology breakthrough which would provide a basis for a threatening attack on our SSBN forces through the 1990s and probably well beyond.**

The TRIDENT II (D-5) missile has successfully completed development and has met or exceeded all design goals. As you know, some problems with the initial TRIDENT II (D-5) submerged launch were experienced last spring. The problems were identified as deficiencies in the design of the missile's nozzle and were quickly corrected, proving once again the value of the superb expertise which resides in the Navy's Strategic Systems Program Office (SSPO). Since the modifications to the missile nozzle have been installed, seven successful test launches have been completed. **The TRIDENT II (D-5) program achieved initial operational capability (IOC) in March 1990, two years ahead of the original schedule.** The FY91 budget requests funding for 52 TRIDENT II (D-5) missiles. The recommended procurement profile is required to support TRIDENT submarine loadouts and the vital evaluation test programs which ensure our confidence in continued system reliability and accuracy.

Recently, concern has been expressed over the shutdown of the Department of Energy's plutonium component plant at Rocky Flats and its potential impact on the TRIDENT program. Rocky Flats is the single supplier of plutonium warhead components which includes the MK-5/W-88 warhead carried by the TRIDENT II (D-5) missiles. The current plant shutdown will not affect the loadout of our next TRIDENT II (D-5) submarine, USS PENNSYLVANIA (SSBN-735) in the fall of 1990. Current estimates indicate that the plant should reopen soon which will enable MK-5 warhead production to meet projected needs.

The TRIDENT II (D-5) missile was designed and has been tested with the capability to carry either the MK-4/W76 warhead carried on the TRIDENT I (C-4) missiles or the MK-5/W88 warhead loaded on TRIDENT II (D-5) missiles on USS TENNESSEE (SSBN-734). This designed flexibility in warhead loadout will allow the implementation of the long-range TRIDENT II (D-5) missile loading plan which will consist of a mix of MK-4 and MK-5 warheads. This built-in capability of the TRIDENT II (D-5) missile has allowed us to develop a number of options which could be executed if the reopening of Rocky Flats is further delayed. These options are undesirable from both a policy and economic standpoint, however, they can be implemented if absolutely required. Therefore, further delays in reopening Rocky Flats should not be a factor in considering the TRIDENT submarine and the TRIDENT II (D-5) missile request in the FY91 budget.

The strategic submarine force is unquestionably a cornerstone of our strategic deterrent force by virtue of its survivability, reliability, and capability. The ongoing modernization of the strategic submarine force is absolutely vital to our national security and must be sustained. The TRIDENT program warrants the full support of Congress.

Senator EXON. Admiral, thank you very much. Admiral Malley, do you have any opening statement?

Admiral MALLEY. I have no prepared statement, Mr. Chairman. However——

Senator EXON. Before we go to the questioning—and I will ask the recordkeeper to follow the usual procedure of 6 minutes per round——

Senator WALLOP. Mr. Chairman, Admiral Malley was about to give us a "however".

Senator EXON. I am sorry. I did not hear the "however".

Senator WALLOP. I am tantalized by it.

Senator EXON. Go ahead.

Admiral MALLEY. However, I thought I would like to add that as the program manager responsible to execute the requirements that come to me to design, develop, produce and test the system, I am very pleased to report what you have already seen and heard—that we have successfully completed the development of the system earlier this year.

To comment on one of your opening statements itself, during the development program we fully tested the Trident II D-5 with both the Mark 5 reentry body and the Mark 4 reentry body. And we tested it in various configurations, up to full load, up through what we would call the equivalent of eight, which really is seven reentry bodies and an instrumentation pod, all the way down to four.

So, in terms of the flexibility and ability of the system to be deployed with less than a full load, that exists today and that is available. There is no additional development work that would have to be completed to do that.

We have also successfully completed our initial operational test and evaluation exercise with the COMOPTV-4 and DOT&E and that was very successful. We had three completely successful shots under that.

Back to what Admiral Cooper said, we are in production and SWFTLANT, down at Kings Bay, GA, is putting out missiles on a routine basis with all of the design fixes incorporated.

That is all I would add to the statements that have already been made.

Senator EXON. Admiral, thank you very much.

Let me give you a compliment to start out with. I remember well last fall when we had that glitch on the D-5 and you all remember what the Appropriations Committee did. We had to turn that around. I am pleased to say that it was one of the few times in the 12 years I have been here that things worked out exactly as the Navy said it would.

If I remember correctly, you said that you had the problem corrected. We all remember that two of the first three missiles failed in their test firings. That is what test firings are for, to see if there is anything amiss. You came and described to me what the problem was and how you were confident you had fixed it.

I believe December 3 was the day, if I remember correctly, and you have not had a failure since. So that was a good job, and you lived up to your commitment. I am so happy that the D-5 has now solved all of its problems.

You know of none or expect none?

Admiral MALLEY. No, sir.

Senator EXON. Thank you very much.

I recognize Senator Thurmond, my friend and colleague, for any opening remarks he might have.

Senator THURMOND. Mr. Chairman, in order to save time, I ask unanimous consent to put my statement in the record. I am very pleased to join you in welcoming these gentlemen today.

Senator EXON. Thank you very much, Senator. Without objection, your opening remarks will be incorporated immediately following my opening remarks.

Let me start out the questioning, then. I first would like to ask you this question, J.D. I am very much interested and delighted to know of the timetables on the U.S.S. *Tennessee* and the U.S.S. *Pennsylvania*. I am more concerned about the U.S.S. *Nebraska*. When will the U.S.S. *Nebraska* be commissioned?

Senator WALLOP. Just after the *Cheyenne*. [Laughter.]

Senator EXON. There is not any *Cheyenne*.

Dr. CROUCH. I would defer on that question. As far as I know, I am not aware that there is——

Senator EXON. You had better know there is a U.S.S. *Nebraska*. It was supposed to come out in 1993. How far behind are you on that? You had better find out.

Admiral COOPER. Right now we think we are on track for March 1993 for delivery.

Senator EXON. For the U.S.S. *Nebraska*?

Admiral COOPER. U.S.S. *Nebraska*. Six months thereafter we would expect it to go on patrol with D-5 missiles on board.

Senator EXON. Thank you very much. With that important question out of the way and having been satisfied, let me ask this question, a more serious question.

Admiral Cooper, as I mentioned in my opening remarks, we would like to know why the Trident RV downloading report is almost 2 months late. We are advised in fact that it is about ready to come over. If that rumor is correct, perhaps you could provide us with a preview of some of the main conclusions at this time.

Admiral COOPER. Senator, I am not usually one to duck questions; however, my good friend Dr. Crouch is the one, so I believe that the request was directed toward OSD, if I may pass the question.

Dr. CROUCH. That is correct. It was our responsibility to take that question.

Senator EXON. I will transfer it to J.D. I hope he knows more about it than he did about the U.S.S. *Nebraska*.

Dr. CROUCH. Fortunately, I do. We are aware, obviously, that the fiscal year 1990 Senate authorization bill required that the Secretary of Defense provide a report on downloading, and specifically you suggested that we evaluate the effect of downloading on such questions as range extension, expansion of operating area, affecting accuracy of the missile and other such things.

The report is still under both construction and review. We hope to get it out as quickly as possible. We at OSD have the responsibility for that report, but obviously it has to be cleared through many channels, including the Navy, and we are working very hard to get it out to you.

I will give you my personal commitment that I will see to it that the report gets up here as expeditiously as possible. We do not have a time frame for exactly when the report will be here, but I would say that in terms of where we are coming out, the emerging conclusions of the report are that at this juncture RV downloading of SLBMs would not be necessary from a submarine security and capability standpoint.

But, obviously, arms control aspects enter into this and in the future there may be important reasons why the United States would want to retain options to download in the context of future arms control agreements.

That is sort of generally where the report is coming out. But I unfortunately cannot report that I can give you a date as to when the report will be delivered to the Senate.

Senator EXON. Well, can you tell us whether it will be over here in 2 weeks or 2 months?

Dr. CROUCH. It would be difficult to say. I think it is unlikely that it would be here in 2 weeks. Again, it is still under both construction and also has to be cleared and reviewed through various agencies, not only the Navy but the Comptroller's office and various agencies within OSD.

If I had to pick—and I do not want to pick, but if I had to pick—I would probably lean more toward the other date.

Senator EXON. Well, I would just say to you——

Dr. CROUCH. I would hope to be able to beat that date, Senator.

Senator EXON. I would hope so, too, because we are having a great deal of difficulty in some areas of our obligations here. Getting information in a timely fashion, which is not new, I think is particularly critical at this juncture, given the constraints of the budget. And if we do not have that information when we go to markup either in the subcommittee or in the full committee, we are going to be further handicapped.

I only sound a warning that you could be at some peril on your program if we do not have the information. So I would recommend that it would be in the interest of the program that you support to get that over to us before we go to markup.

Dr. **Crouch**. Your point is taken, Mr. Chairman. I understand, having been on the other side of the process, how important these documents are to markup, and we are going to try and deliver in time to have an effect on your deliberations up here.

Senator **Exon**. Especially since it is so late at this particular juncture.

Admiral **Cooper**. Mr. Chairman, excuse me. If I could interrupt for just a second, we can give you some of the facts on downloading and ranges as Admiral Malley has seen now through the testing we have done, so we can give you a few of those things right now for the record, if that is what you desire, if that would help.

Senator **Exon**. That would be helpful.

Admiral **Halley**. As I said earlier, we have tested the Trident II D-5 with the Mark 5 in various download configurations. [Deleted.] Based on the testing to date, the accuracy of the system at that range, which I will give you—there are many different accuracies depending on the fuse option you pick, but [deleted]. Now as you download from [deleted] nautical miles.

Going on down to an offloaded configuration where you get down to [deleted] so you cannot put any more range into it than that. [Deleted] from what you have at the [deleted] nautical miles, so that would probably be around [deleted] feet in that regime. That is based on the testing we have done to date and the analysis we have.

I should add that when we get down to five reentry bodies we have to start adding ballast to the system because the center of gravity gets upset and you have to keep the bird flying straight. So that range versus payload takes a change when you get down to five like that. [Deleted.]

Senator **Exon**. Let me ask you this question. The [deleted] within the desired accuracy?

Admiral **Malley**. That is much better than we ever anticipated we would get. [Deleted.] We have come out much better than we had anticipated. All subsystems contributed, not only the missile but the guidance, the fire control, and navigation subsystems.

Senator **Exon**. How does that compare with the MX in silos?

Admiral **Malley**. I do not have the specific MX numbers, so I really cannot compare it. But based on the yield we have and from what I have heard, I would say that the probability of kill was equal, if not a little bit better, with the Trident II at tactical ranges. But I do not have exact information on that.

Dr. **Crouch**. I think that is correct.

Senator **Exon**. If you could supply that for the record.

Dr. **Crouch**. We will supply that for the record. I believe that the Trident II system is marginally more accurate than the Peacekeeper in silo.

[The information referred to follows:]

[Deleted.]

Nevertheless, both the Peacekeeper and D-5/Mk5 have unique characteristics which contribute differently to our Triad, and to our ability to deter. In particular, the capability of the Peacekeeper to respond promptly makes it a more effective weapon against time urgent hard targets than the D-5/Mk5. Conversely, the D-5/Mk-5 are used more effectively to hold at risk those hard targets which are not time urgent in nature.

Senator **Exon**. Thank you very much. I am pleased to yield to Senator Thurmond.

Senator **Thurmond**. Dr. Crouch, I want to ask you a question on the Trident warhead under START. Under the 4,900-warhead START limit, do you believe that each Trident should carry the full complement of 192 warheads? That would put 70 percent of our strategic warheads on submarines.

Dr. **Crouch**. It is true that under START we would have 4,900 ballistic missile reentry vehicles. We have not at this juncture determined what our exact post-START force structure would look like. A post-START force structure that allowed for roughly 18 START-accountable Tridents would come out with roughly 3,400-3,450 RVs if they were all Trident RVs.

In such a force, this would allow for some approximately 1,500 warheads deployed on the ICBM force. As you know, we currently have a greater proportion of the warheads in our ballistic missile forces on submarines, and we believe that while we do not know the exact mix, that in a future environment a balance like that would be justified.

For instance, 1,500 warheads would account for both the Peacekeeper Rail Garrison program, 500 Small ICBMs, and roughly 500 warheads on Minuteman IIIs.

Senator **Thurmond**. Admiral Cooper, a question on the ban on MIRVs. What would be the impact on the Navy's submarine-launched ballistic missile program if, as some suggest, we negotiate a ban on multiple-warhead missiles and permit only single-warhead missiles in silos and on submarines?

Admiral **Cooper**. If I may please have Admiral Malley, the technical project manager, answer that, I think you would get a better answer, Senator.

Admiral **Malley**. The Trident II D-5 is not designed to fly with only one warhead on it, without putting on seven pieces or some pieces of ballast, at least up to five, to make it look like it has the right weight on it. Otherwise, it would not survive.

So, if you wanted to go to a system wherein you only had one RV per missile, it seems to me what you would have to do is go out and start a new design, because you would have an awfully big missile there that has much more capability to get those ranges. So, depending on how you want to approach that, you would have to redesign the system and perhaps look at a smaller missile, going back to something the size of the old Polaris missile.

Senator **Thurmond**. Admiral Malley, a question on the small submarine program. There have been some proposals that call for the Navy to begin a long-term research program on a smaller ballistic missile submarine. The argument is that these submarines would allow United States strategic warheads to be deployed on a greater number of launch platforms and then be less vulnerable.

Is such a proposal being considered, and what are the limitations on building smaller ballistic missile submarines?

Admiral **Cooper**. If I may take that, Senator, the fact is that we did a lot of studies back in 1969 and 1970 as we looked at the various, what we called underwater-launched missile, systems and finally came up with Trident. We looked at variations of the numbers of missiles that you would carry on those and finally decided on 24, having already gone through the process of having the Polaris and Poseidon submarine hulls with 16.

The decision was made to go with the 24 because that was by far the most economical way to do it. And with all the quieting modifications that we have made and with the much larger area of operations that we have as a result of the longer-range missile, I think it would be a grave mistake and a very costly one to go into design now for a submarine that would be smaller and carry a smaller number of missiles.

We have no such design program now.

Senator **Thurmond**. Admiral Malley, a question on the D-5 warhead. It is by no means certain that DOE will be able to supply W-88 warheads for the D-5 missile. If you have to load the Trident with a mix of C-4 and D-5 warheads, do you have all the necessary adapters and hardware available to do so?

Admiral **Malley**. My understanding is the Department of Energy has plans to resume production by this summer. I cannot speak for the Department of Energy on what they are actually doing in that area, but that is what they have advised us. We have also been informed that if they should restart by, say, October or November there will still be adequate warheads delivered to us to meet the requirements for our third outload.

Now, if that does not come to pass, we are in the process now of procuring additional adapters for the Mark 4 reentry body to come off the Trident I C-4s, so that we would be in a position to be able to use those warheads on Trident II D-5s, if required.

Senator **Thurmond**. Admiral Cooper, in your statement you described the option of loading C-4 warheads on the D-5 missiles as undesirable from both a policy and economic standpoint. Can you comment on this option from a purely military standpoint, and will the target coverage be effective?

Admiral **Cooper**. The target coverage effectiveness is strictly dependent upon what the targeting is from JSTPS in Omaha. The point that I would make and I was attempting to make in my statement was that the D-5 missile, because of its accuracy and because of the improvements in modernization we have put into it, can in fact cover all targets that are now out there, and therefore it has the hard target kill capability at a larger range.

So it is by far preferable to continue with the D-5 program, which I think is really the answer to your question.

Senator **Thurmond**. Mr. Chairman, my time is up.

Senator **Exon**. Thank you, Senator Thurmond. Senator Gorton.

Senator **Gorton**. Admiral Cooper, you made a glancing reference during your formal testimony to the missile readiness for the Trident submarines as they come on line. Are you able unequivocally to assure the committee that the schedule for the Trident submarines of one a year through and including the one for which authorization is requested this year, when they come on line will all have the full availability of operable D-5 missiles without delay?

Admiral **Cooper**. I can state that absolutely by the time the 18th comes on that whatever problem is existent now will be solved. That does not impact the 18th. We have looked at what has to be done if in fact, as we go along DOE has the problem at Rocky Flats.

Right now, we have to make no decision at all until December of this year as to what we might do to make any changes. We could today in fact put the RVs on every missile for the first two submarines at eight RVs per missile, and the third one, which is the *West Virginia*— and it goes to sea a year from June——[deleted].

That means it would be 2 years later before we had to do something further. The decision does not have to be made until December of this year. As Admiral Malley said, he is getting the necessary equipment in order to do any Mark-4 work or C–4 work that he would have to do.

I could obviously not unequivocally say anything, but the answer is that we have a plan and have looked at it very carefully to make sure that we do the logical steps as they are necessary to be done, and do not spend an improper amount of money making plans for things that do not make sense if the solution is made.

Senator GORTON. These assurances, to the extent you have made them, are all premised on schedules for restarts of nuclear facilities furnished to you by the Department of Energy?

Admiral COOPER. Only on the D–5 part of it. If they come on line as Admiral Watkins I believe has said, at that time or even a few months later, in fact we will continue on with the D–5 missile with the Mark-5 warheads. If in fact they are delayed even further, then we have plans available that we can put into action that will in fact put us out there at sea with whatever mix of warheads we need to have.

Senator GORTON. Dr. Crouch, some of the various arms control groups here and I guess even in the Soviet Union are at least broaching suggestions about SLBM-free zones along the coasts of the United States and of the Soviet Union. Are those proposals attractive? Are they workable if we should enter into them? What kind of comment do you have on those suggestions?

Dr. CROUCH. Well, I think my general reaction to those types of proposals—and obviously I would want to know specifically what the proposals were—would be negative. To start with, one of the main reasons that we have gone to such great lengths to quiet submarines and the like is so that we can keep them survivable and they cannot be found in the open oceans.

That is the primary role of our strategic submarine force. I think that we want to be able to have the ability to move our submarine force anywhere, either in wartime or peacetime, so any restriction of navigation would be contrary to the general proposition supported by the Navy and by the administration that there should be no restrictions on movement of naval vessels.

From a practical standpoint, given the range of most of the modern SLBMs, it does not make a lot of sense, it seems to me——

Senator GORTON. To place those kinds of restrictions.

Dr. CROUCH. That is right. From the standpoint of the Trident, we would be able to engage from much of the open oceans from the Trident D-5.

Now, I would say that the Soviets currently operate out of bastions and a proposal for an SSBN-free zone would restrict the United States much more because we do not operate in such bastions, at least not in the limited space that the Soviets do. So, in a way, I think from a U.S.-Soviet perspective, it cuts more against the United States than it would against the Soviet Union.

Senator GORTON. Thank you. Thank you, Mr. Chairman.

Senator EXON. Thank you, Senator Gorton. Senator Wallop.

Senator WALLOP. Thank you, Mr. Chairman.

Admiral Malley or Cooper, either of you, if we went into some sort of agreement that would limit sea-launched ballistic missiles to one RV per missile, you would not only have to redesign the missiles but you would have to redesign the boats, essentially, would you not? In other words, it just seems hard for me to believe that a boat with 16 or 24 single-warhead missiles floating around the ocean is cost-effective, given the current time.

Admiral COOPER. It certainly is not cost-effective, and we obviously would have to make great changes and very costly changes to the missile. As far as the submarine itself, I do not know that there would be a whole lot of changes, depending upon the weight of the missile and the ballasting of the submarine. But the missile itself I am sure—and I defer to Admiral Malley—would be very costly.

Senator WALLOP. Well, let me rephrase the question. I did not mean you would have to redesign it in order for the boat to carry them, but it is an awful lot of boat for 24 RVs, wouldn't it be—just basically wasting resources that have already been spent?

Admiral COOPER. Except for the survivability factor. That is the major factor that you would be looking at in the submarine. But, yes, you are correct; for the number of warheads, an obvious advantage of a submarine is having the total number of warheads that are out there.

Dr. CROUCH. If I might say, the enhanced survivability that we purchased at some great cost in the Trident program does provide an incentive in that program to place more warheads on that survivable platform. So it is certainly right to say that to reduce it to 24 would not be taking full advantage of the survivability that is inherent in the system.

Senator WALLOP. Speaking of survivability, what are the vulnerabilities now that you see on the horizon that might have to be addressed in terms of new Soviet ASW capabilities?

Admiral COOPER. We are constantly looking and have a specific program called the SSBN Security Program in which we attempt to find out what vulnerabilities might be out there, and we have looked at such things as emissions of any kind from the submarine. We have looked at such things as the vortices and Bernaulli effect on the ocean as the submarine goes through the water.

We have had scientific people come in. We have a large group of very well-known people—Dr. Edward Freeman from Scripps and people from around the country in academia—trying to analyze what phenomenology might in fact be out there and give us a law of physics that will make the oceans transparent.

We have spent a good bit of money on that. And anything we came up with we then tried to look on the other side to see what will decrease whatever vulnerability is found. There are several things that you can do.

One of them is merely operate your submarines slightly differently. The main thing we have done is by getting increased range of the missile we have increased greatly, as you heard, the area in which they can operate.

So we have not, right now, specifically identified a specific vulnerability. But we are constantly looking. We even have the [deleted] doing a highly classified project so that they will be divorced from what the Navy is doing so that you have separate heads looking to see what might, in fact, be a possibility later on.

But, as I mentioned earlier, the [deleted] comes out each year and analyzes just how you are doing, and they will only predict [deleted] ahead. Right now they say there is nothing on the horizon to make the SSBN vulnerable.

Senator WALLOP. Do you worry about some of the new ebullience of the Department of Commerce and others with regard to U.S. technology?

Admiral COOPER. Oh, yes. You constantly worry about that. And primarily I worry not as much that they will come up with some new thing in ASW as I worry about the fact that they will understand what we are doing more and more in quieting.

Senator WALLOP. And apply it to their own?

Admiral COOPER. That is right, and make theirs quieter. Why our sensors work so very well—and they do and they are much better sensors than the Soviets have right now, and yet if they can get some of that technology transfer, I am very concerned in that respect.

Senator WALLOP. Does the Defense Department have or is it developing a strategy to identify these capabilities?

Dr. CROUCH. Yes. In fact, the administration is undergoing a review, which is just finishing up, [deleted] that essentially takes a look at the broad range of military technologies that we believe, even given the changes in Eastern Europe and the Soviet Union, still need to be protected.

[Deleted.]

I would add that one of those areas that we are extremely concerned about and supporting the Navy wholeheartedly in, is the area of any type of technology that would give the Soviets better insight into our quieting technologies or into anything that has an impact on ASW.

Senator WALLOP. Mr. Chairman, I think given the interesting responses I would hope that this committee would not be one that would fall into the beguiling sound of an SLBM-free zone. For one thing, I do not know how you could verify it, that we are where we are supposed to be. Second, I am not exactly certain, as is the case with most arms control, what we would do about it if we found somebody in the zone.

I just hope that this committee can keep the cool head when those rather dazzling ideas get floated. Thank you.

Senator EXON. Thank you, Senator Wallop. We will start our second round now.

Gentlemen, you have testified, if I understood your testimony correctly, that as far as you can see into the future—I believe you indicated that would be at a minimum into the first or second decade of the 21st century—you see no chance that the Soviets would be able to track or identify where our Tridents are once they go to sea; is that correct?

Admiral **Cooper**. That is correct, yes, sir.

Senator **Exon**. Conversely, what is our ability to track and identify their "boomers"? I would like to think that we are in a better position than they are in that regard. Is that an accurate assumption on my part?

Admiral **Cooper**. Yes, sir.

Senator **Exon**. Can you go into that in any more detail?

Admiral **Cooper**. I am very hesitant to do that at this point. I would be glad to talk to you sometime and tell you just exactly what we do, or anyone. Obviously, I would rather not do it in this forum.

Senator **Exon**. Thank you. I accept that. I thought that might be your view. I do think it would be helpful to us if we could have your confidential discussion with as many of us as possible, one-on-one or otherwise, in that particular area.

Admiral **Cooper**. I would be glad to get that set up, sir.

Senator **Exon**. Admiral Cooper, in your statement with regard to the Navy goal you state, "21 operational Trident submarines with two or three Tridents in overhaul." In choosing the word "with" in that statement, did you mean in addition to the 21 operational Tridents? Or did you mean that the 21 operational Tridents would include the two or three that would be in overhaul?

Admiral **Cooper**. As I wrote that statement, I meant 21 operational and two or three in the yard, not countable—21 operational and countable and two or three in a shipyard, not countable. OSD has made the statement that at least 18 should be operational, plus two or three.

There is a slight change there. I am saying that with 21 operational that then would give you 4,032 warheads, if you count eight for each missile.

Senator **Exon**. So you are still anticipating there would be 23 or 24 of the Tridents; is that correct?

Admiral **Cooper**. Anticipating is a word that I would back off from. It is what I would like to see.

Senator **Exon**. Is that what you would like to have?

Admiral **Cooper**. Yes, sir.

Senator **Exon**. Has the Navy fiscal year 1992-1997 POM submission been calculated along that line, to procure more than 21?

Admiral **Cooper**. It is a very difficult thing to discuss the POM. The POM is an ongoing decision process, and I really do not know exactly where it stands right now. All the POMs from the services have gone down to the Department of Defense. They then do a thorough review during the summer and there have been several different discussions ongoing and I really just cannot discuss it because I do not know exactly what is in that POM.

We have, right up to now, this year, requested the 18th Trident and we are requesting advanced procurement for the 19th and the 20th. That is really the best answer I can give you right now.

Senator **Exon**. So I guess you are saying that that decision has not been made.

Admiral **Cooper**. It has not been fully made; that is correct.

Dr. **Crouch**. I can add to that, Senator, that the POM submissions have just very recently come to the Office of the Secretary of Defense, and I think they are under review by the Secretary now. I can assure you that that decision has not been made at this juncture.

Senator **Exon**. It has what?

Dr. **Crouch**. It has not been made at this juncture.

Senator **Exon**. It may not have been made, but I think, as you are aware, with the statement the Secretary gave us that we probably will not build more than a maximum 20 or 21, given the current outline of the pending START agreement.

Is it safe to assume at the present time, Doctor, that the likely maximum procurement, from what you know, would be 20 or 21 rather than 23 or 24?

Dr. **Crouch**. I would support what the Secretary of Defense said, yes—that probably 20 or 21 would be the maximum procurement. I would add that, depending upon the outcome of arms control agreements and how we would structure the numbers of warheads on those forces, it is possible, if you were to make a decision theoretically to download, let us say, two warheads off of the D-5 and have it count as six instead of eight that you could deploy additional Trident SSBNs.

There is no direct limitation in START on the number of SSBN hulls.

Senator **Exon**. My time is up. Senator Thurmond.

Senator **Thurmond**. Thank you, Mr. Chairman.

Admiral Malley, I have a question on the Trident missile production cost. Last year Congress approved $1.2 billion instead of the $1.6 billion requested and authorized for Trident missile production. What effect did this slowdown have on the cost of the Trident program?

Admiral **Malley**. Let me just make sure I get this straight. With respect to the fiscal year 1990 procurement, which is less than before, you are speaking of the fiscal year 1990 procurement?

Senator **Thurmond**. Yes, fiscal year 1990.

Admiral **Malley**. We ended up with a reduced number of missiles procured that year. We are ending up procuring 42 missiles in fiscal year 1990. What that has done is increase the unit cost. I do not have the specific number in front of me, but it is roughly about 16 to 20 percent of actual procurement cost for ourselves and also for the few missiles we have been buying for the United Kingdom that year.

Senator **Thurmond**. Admiral Malley, have the costs of the British Trident missile increased over the last year, and why?

Admiral **Malley**. The cost of the British missiles are the same as the cost of the U.S. missiles. We buy and it is just thrown into the same annual procurement, so their costs went up this year by the same amount the U.S. cost did, because of the total reduced U.S. buy.

Senator **Thurmond**. Now on the Trident performance schedule, in your testimony you note that the Trident missile achieved initial operational capability two years ahead of schedule, yet the Congressional Budget Office reports that the IOC was delayed because of a rocket nozzle problem. Would you please clarify this?

Admiral **Cooper**. Yes, sir. The clarification would be that we started this program back about 1980 to look at the D-5, what we could do to improve the accuracy and give it a hard target kill capability. In about 1982 or 1983 we were told, okay, the Department of Defense wants to improve across the board the strategic triad. Navy, what can you do?

We said we can accelerate the introduction of the Trident D–5 missile, and instead of putting it on the first backfit, which would be the *Ohio*, in 1993 or 1994 when it comes out of the shipyard, we can in fact put it on the ninth Trident submarine.

We did in fact put it on the ninth Trident submarine, which is the *Tennessee*. Therefore, that missile went to sea approximately 2 to 2½ years earlier than we had originally projected in 1980.

Senator THURMOND. Admiral Cooper, the Soviet modernization of their strategic missile submarine force, by all accounts, continues unabated. How would you compare the current capabilities of both the Delta-4 and Typhoon-class submarines to our *Ohio*-class Trident submarine?

Admiral COOPER. The capabilities would be in two or three areas. One is that the Typhoon submarine carries 20 missiles, while the *Ohio*-class Trident carries 24. The Delta-4 submarine carries 16 missiles.

Second, those submarines are not as quiet as the Trident. The Trident submarine is the quietest submarine in the world today.

We believe from intelligence estimates that the accuracy of their missiles is not as close as ours. The Trident D–5 or C–4 missile I believe is more accurate than the missile they have on their D–4 or Typhoon submarines.

Overall, I would say the Trident submarine is the quietest and best missile submarine in the world today.

Senator THURMOND. Thank you, Admiral, and thank you, gentlemen, for your testimony. Mr. Chairman, that is all the questions I have.

Senator EXON. Thank you, Senator Thurmond. Senator Wallop.

Senator WALLOP. Mr. Chairman, Senator Levin just came in.

Senator LEVIN. No, please.

Senator WALLOP. I only have two. One is, with the extended range and the slightly [deleted] do you still consider it hard target kill capability?

Admiral MALLEY. Yes, sir.

Senator WALLOP. So that that slightly [deleted] does not——

Admiral MALLEY. The slightly [deleted] is what we call probability of kill in a single target. It is up to the JSTPS strategic planners as to how they would target those weapons, given a slightly [deleted] P of K, but it is still a very effective weapon [deleted].

Admiral COOPER. If I may give you a picture of the accuracy of this missile even at the [deleted].

So it may not be hard target kill, but it will sure scare the dickens out of you.

Senator WALLOP. Are there proposals in Geneva now which cause DOD any anxiety about the utility of this part of the triad in terms of limitations on numbers of warheads or counting rules?

Dr. CROUCH. No, there are not. We believe that the 4,900 ballistic missile warhead limit that the START Treaty has would provide ample room for a mix of ICBM and SLBM warheads that would be required in a post-START world.

We also successfully negotiated the ability to have two or three—we are not sure how it is going to come out—missile submarines in drydock and overhaul, which in fact sort of replicates the current situation of the U.S. force structure that would not be countable under START.

So, this gives us some additional flexibility. As I said, one of the things that is under consideration is possibly whether or not in the post-START force structure you would want to have some flexibility in terms of downloading, and I understand that the committee is very interested in that. That is the report we owe you on the subject.

We think that overall the START Treaty, with respect to the SLBM leg of the triad, is very flexible and gives us all the room we need.

Senator WALLOP. Would DOD and the Navy both be inclined to resist suggestions from Congress that we anticipate the results of START I and perhaps START II and begin downsizing the SSBN fleet?

Dr. CROUCH. Well, we are planning our force structure to be consistent with START I, so we do not know exactly, as I stated earlier, what the mix of forces is going to be, but it is our intention that currently, with our current request, in fiscal year 1991, which is the 18th submarine, we are looking for long-lead procurement on the 19th and 20th, that those would be consistent with any conceivable post-START force structure.

As far as START II is concerned, we have not made a decision within the Government whether or not we are going to be pursuing follow-on negotiations. We still have a lot of details and, I would say, some rather important provisions of this agreement to negotiate. We believe we are making progress, but it is going to take some time and, therefore, the idea of focusing in now on START II, it seems to me, would be imprudent, particularly since we have not established, A, whether we are going to be engaged in those negotiations or, B, what our objective in those negotiations would be.

I think that is more important, what our objectives would be in those negotiations.

Senator WALLOP. Mr. Chairman, I am, one, glad to hear that, and two, quite agree with it. It strikes me that one of the problems with the ABM Treaty was the anticipation subsequent to its signing that we would have an immediate and drastic reduction in ICBMs, which of course we did not get. And we found ourselves bound by a treaty which was sold to the Senate on the basis that it ought to be rejected 5 years down the road if we had not achieved those major reductions in ICBMs.

I worry a little bit as I hear the administration talking about possible follow-on to START that we build in an excuse for inaction, and I just hope that this committee would see to it that START I achieves as much as immediately necessary and that we do not anticipate that we can achieve more in a START II and that when START I is done and signed, if there is need for a START II we would begin afresh but without anticipating.

Dr. CROUCH. If I might add to that, Senator Wallop, the START treaty, as currently envisioned, would have reductions taking place not instantaneously but over a number of years, about 7 years, to bring down to the 4,900 sublimit, and the agreement would be in existence for at least 15 years.

So, we are talking about a process of bringing the warhead totals down over a number of years. If we were to commit to START II negotiations, it is possible that we would begin doing that in that time frame, but there would still be reductions ongoing throughout the process.

Senator **WALLOP**. It is my hope that we do one thing, and then make a commitment to a second thing. Thank you, Mr. Chairman.

Senator **LEVIN** [presiding]. Thank you, Senator Wallop.

There was some discussion about downsizing or downloading. Is that the way you talk about reducing the number of warheads? Admiral, I gather that if we went above 21 subs, Trident subs, that we then might have to downsize the number of warheads per sub. Is that what you are contemplating?

Admiral **COOPER**. The number of RVs per missile, yes, sir.

Senator **LEVIN**. From what to what?

Admiral **COOPER**. It would strictly depend upon——

Senator **LEVIN**. Approximately to what.

Admiral **COOPER**. Right now, we are countable for eight. That is defined and decided as far as START goes. If we were to downsize to, I think Dr. Crouch said, if you take two off each submarine that would allow you to have one or two more. I would have to sit here and work out the math.

Senator **LEVIN**. So that would be down to six?

Admiral **COOPER**. That would be down to six, yes.

Senator **LEVIN**. Per missile?

Admiral **COOPER**. Six RVs per missile times 24.

Senator **LEVIN**. Does the START agreement, as presently contemplated, allow for us to download, or does it assume that each boat has eight?

Admiral **COOPER**. You can download to whatever you want to, but in fact the counting rules count eight per missile.

Senator **LEVIN**. If you went down to six, would that counting rule not still be on the books?

Admiral **COOPER**. Right. As of right now, unless negotiated further.

Senator **LEVIN**. Is not the current posture of the United States that we should count eight?

Dr. **CROUCH**. That is correct.

Senator **LEVIN**. So that our current arms negotiating posture is inconsistent with what your need would be to go above 21?

Admiral **COOPER**. One thing that is in the START agreement, pretty much agreed to right now, is in fact we will be allowed two or three, as long as we keep them in the shipyard and they will not count. So right now the 21 only would count. The two or three would be in such a position that the Soviets could see it would not be usable and therefore not operational and therefore not countable.

Senator **LEVIN**. I understand that. But even with the two or three in overhaul, we still would have to go down from eight to some lower number, would we not, in order to avoid having 80 or 90 percent of our RVs on subs under the current contemplated START limits?

Dr. **Crouch**. The exact percentage, as I said earlier before you came in, Senator of what the post-START force structure is going to look like, has not been determined exactly.

Senator **Levin**. Let me get back to the eight and six issue. Let us assume for a minute you have to go to six in order to meet the START limit and keep a balanced force. You are assuming we might have to go to six, Admiral. What I am asking you is, does that not assumption run counter to our current arms negotiating posture, which is we are going to count those boats at eight?

Admiral **Cooper**. Yes. I did not understand your statement that I assume we have to go to six.

Senator **Levin**. I maybe misunderstood you. I thought you said we might have to change the number of RVs per missile from eight to six. I assume it would not make any difference if you count every missile at eight.

Dr. **Crouch**. The answer is no. You would not have to, under our current position, under our current arms control position, download from eight to six. Maybe I am misunderstanding the question.

Senator **Levin**. Is it our current arms control position that every Trident missile is going to be counted at eight no matter what the number is?

Dr. **Crouch**. Correct.

Senator **Levin**. So whether it has 10, it is going to be counted as eight?

Admiral **Cooper**. Presumably it will not have 10, but it is counted as eight.

Senator **Levin**. And if it has six, it is going to be counted at eight?

Dr. **Crouch**. Correct.

Senator **Levin**. So even if you downloaded to six, it does not do you any good.

Admiral **Cooper**. That is correct. That is right.

Dr. **Crouch**. That is correct.

Senator **Levin**. That is our current arms negotiating position.

Dr. **Crouch**. Yes, sir.

Senator **Levin**. So our current arms negotiating position is inconsistent with your proposed solution, which is to download it to six, because it will not do any good.

Dr. **Crouch**. What I am saying is we do not need the solution under what we plan to procure.

Senator **Levin**. Under the 21 procurement you do not, but under the 24 you do, because the Admiral, as I understand it, wanted to go to 24.

Dr. **Crouch**. I do not believe that is correct.

Admiral **Cooper**. In my statement, I said the Navy would desire to have 21 operational and, therefore, they count, and we would like to have two or three that are obviously not operational because they are in a shipyard in a position where they would not count.

Senator **Levin**. I understand, but you have got 21 up or operational, and you count 192 warheads, that is going to get you up to 4,032 warheads, and out of a total of 4,900 warheads, if that is the cap, it means that you are going to have 90 percent of our ballistic missile force at sea.

Admiral **Cooper**. And that is a decision——

Senator **Levin**. Is that what the Navy is assuming, that we can have 90 percent of our ballistic missile force at sea?

Admiral **Cooper**. We are assuming you could, yes, sir. But that is not our decision. That is a decision that has to be made by the Department of Defense.

Dr. **Crouch**. If you were to have 900 ballistic missile warheads on ICBMs out of the 4,900 sublimit, that would roughly work out to be far less than that. It would be about 75, 70 percent, I believe.

Anyway, in terms of downloading, one of the things I would add to you is we are considering the question of being able to have a downloading provision.

Senator **Levin**. I have got to go vote. I am sorry to do this to you. You are considering offering a provision in the negotiations?

Dr. **Crouch**. No. We have not made a decision on that, but the Soviets have suggested to us or proposed to us that we have a downloading provision in the negotiations.

Senator **Levin**. And we have not responded yet to that?

Dr. **Crouch**. No.

Senator **Levin**. All right. Thank you. Sorry for the interruption. Two quick questions. Do you know what the cost of downloading would be to us?

Admiral **Malley**. The financial cost? There is no financial cost.

Senator **Levin**. Okay. Second, one other question to you, Admiral, and then I am going to run. Let me see if I can make this vote.

There have been some stories in the press about a program for training dolphins to protect Trident bases, including one report that says they are going to be outfitted with spring-loaded .45 caliber bullets attached to their noses. Can you tell us what is going on here?

Admiral **Cooper**. [Deleted.]

Senator **Levin**. Thank you.

Senator **Exon** [presiding]. Thank you, Senator Levin. Senator Levin and others may have additional questions for the record. We would ask that you please follow the usual procedures in giving us as prompt a reply as possible for any questions that are posed by any members of the committee. I have a couple more things I would like to cover and then I think we can thank you at that time for being here. On page two of his statement Admiral Cooper says "the Trident II missile allows the sea-going force of the triad for the first time to engage in the full spectrum of targets", and then he goes on on page three to say "the strategic submarine force is controlled through a reliable, redundant, continuous and reconstitutable communications system."

Taken together, it seems to me that those two statements would appear to make SLBM warheads interchangeable with ICBM warheads. Does the policy community agree with that, that with the introduction of the Trident II missile, ICBM warheads and SLBM warheads are basically interchangeable for purposes of the SIOP?

Dr. **Crouch**. No. We would not agree that they are interchangeable. I am not certain whether Admiral Cooper would agree that they are completely interchangeable. I think there are elements to both the ICBM and SLBM legs that still require us to maintain a balance of ICBMs, SLBMs and bombers in the triad.

I would say that there have been remarkable advances in terms of accuracy and in terms of communications in the SLBM leg that allow it to do the things that Admiral Cooper pointed to. But I would not say that they are exactly the same.

I do not know whether you would want to add to that.

Senator EXON. Well, I will ask them to comment on your statement in just a moment, both of the Admirals. But as a follow-up question, Dr. Crouch, in what ways do you regard SLBM warheads as less effective than ICBM warheads? Is it in accuracy? Is it in command and control or what?

Dr. CROUCH. Well, I think that in terms of accuracy one of the things we have to take into account in our current force posture is that the Peacekeeper Rail Garrison system—I should say both the Peacekeeper Rail Garrison system of the future and the Peacekeeper in the silo programs—provides us with prompt retaliatory capability against the full spectrum of targets.

Right now we have only one Trident submarine outfitted with the D-5 missile. In the future, obviously, we hope to have more.

I think that the ICBM leg of the triad also provides us with the best and surest means of command, control and communications. While I would not want to dispute the fact that there have been great improvements in that area, I think that it is safe to say that the ICBM leg of the triad provides the best connectivity of any of our strategic programs.

Therefore, I think it has some advantages, although they are getting smaller, over the SLBM leg of the triad.

In terms of alert rates, I think that there are also some advantages to the ICBM leg of the triad. While the missiles deployed at sea on SLBMs are certainly on alert and at various stages of alert while going on station and off station, while they are in base—I believe it is about 30 percent of them in base at any one time—they are not on the same state of alert as ICBM warheads, which are on a constant state of readiness.

So, I think there are some differences that do provide the ICBM with capabilities that we need to retain.

I would point out one other factor that I think is important as well, and that is, depending upon the targets that you are engaging, the ICBMs can be used in fairly selective fashion in the sense that they can be shot from individual silos, obviously, one at a time. While this can be done for SLBMs as well, it may not be the preferred operational mode for the use of those SLBMs.

Senator EXON. Would it be safe to say, then, Dr. Crouch, that one of the advantages of the ICBM over the SLBM is command and control? Is that right?

Dr. CROUCH. Well, there have been improvements in command and control on both sides, and I think I do not want to belittle the improvements in connectivity that have been part of the Trident force. I guess that is where I am hedging a little bit.

Senator EXON. I do not want you to hedge, but do we not all agree, even at this level of security, that we are in a position to retaliate much quicker, with our land-based ICBMs than we are with our "boomers" at sea?

Dr. CROUCH. That is my understanding, yes.

Senator **Exon**. Admiral Cooper, would you care to give us your views on the question?

Admiral **Cooper**. There is some disagreement, Senator. I would not necessarily buy into everything that Dr. Crouch has said. However, I am biased. I would say to you that on the communications we have, for 10 years, analyzed every single patrol that we have had, and we have a [deleted] delivery of every single message that has gone out.

We have redundancy in communications now that I do not think any other system in the whole world ever had, with the various frequencies we have, with the various methods of getting the messages out there, and with the various tests that we have run.

We not only run tests throughout the time that the submarine is on alert, we also have every single thing the submarine does, both operationally and communications, analyzed by Johns Hopkins University Applied Physics Laboratory. We send them all sorts of documentation after every single patrol and it is thoroughly analyzed by them.

We have done everything that we possibly can. We have also had several studies done to talk about the communications, and I would merely suggest to you I do not know anything about the ICBMs or the ICBM communications. I know some, but I do not know it like I do SSBNs, and I would suggest to you that it cannot be much better. There is not much to be better at.

I think that when you get into a stressed condition, when you get into a condition of EMP, jamming, that sort of thing, you would find that there is not much difference in the communications. But I am not an expert on the communications of the other. We certainly have the accuracy.

And another aspect of this thing is that we do not have to fire promptly. If in fact there is an attack, there is no launch under attack as far as the SSBN goes. You can fire one missile or six missiles or all missiles, if we desire. There is no requirement to fire all at once, or any. It can stay out there until the order is given to fire now, at such and such a time.

We also have the mobility to move around from place to place, and if in fact you want better accuracy—let us say we are only at [deleted] miles and we want better accuracy. Fine. I will move my submarine closer to the target.

I think you will find that time on target, as you launch from the land-based missile and you launch from a submarine, a submarine is much closer to the target. Therefore, the time on target from the time the message leaves the White House and it gets to the particular firing piece of equipment, it may be longer to get to the submarine, but in fact the flight time from the submarine is shorter than that from the land-based missile.

Your time on target will be about the same. There are lots of things that have to be discussed in much more detail, but I am biased.

Senator **Exon**. No, I do not believe you are biased. I am not trying to argue the merits or demerits of either system. I am just asking the question of command and control. We do not want to leave you out, Admiral Malley. Are you prepared to say that command and control is better on the ICBM than the SLBM?

Admiral MALLEY. I do not know enough about the ICBMs to say, sir. I really do not.

Senator EXON. Well, at least I appreciate the fact that you have been up front with us on it. I did not mean for a moment to downplay the role. At least it has been my assumption that the ICBMs are there for launch under attack, and that has been one of the survivable factors that we have always used in describing this. And I just assumed—and maybe I assumed incorrectly—that our command and control and communications are quicker and better to the Cheyenne area missile fields than they are to a "boomer."

Admiral COOPER. That is a very prevalent assumption that everybody makes, and that is the reason we have worked so hard to analyze what we do, to have the ongoing testing that we do, and we do it by independent agencies. So, that is the reason I want to get us away from that being a degrading factor within the SLBM force.

Senator EXON. So you recognize that that is an assumption, but you are not agreeing necessarily with that assumption; is that correct?

Admiral COOPER. That is correct, yes, sir.

Senator EXON. Thank you. Senator Wirth.

Senator WIRTH. Thank you very much, Mr. Chairman.

Gentlemen, thank you for being here. I am sorry I was not here earlier. I wanted to briefly touch, as you might imagine, on the relationship of Trident to Rocky Flats.

We are trying to understand what kind of national security concerns exist related to the reopening of Rocky Flats, and I know you have been through some of this. But on the next-to-last page of your testimony you say "the current plant shutdown will not affect the loadout of our next Trident II, the U.S.S. *Pennsylvania*, in the fall of 1990."

Does that mean that you have enough MK-5s in inventory?

Admiral COOPER. Yes, sir.

Senator WIRTH. To take care of the *Pennsylvania*?

Admiral COOPER. Yes, sir.

Senator WIRTH. What is next on line, the *West Virginia*?

Admiral COOPER. The next one is the *West Virginia*, [deleted].

We are in fact satisfied for the next 2 years, and any decision that we have to make as to exactly what plan we carry out—and we have several plans of action—any decision we make does not have to be made until December of this year.

Senator WIRTH. You say you are satisfied for the next 2 years, which means that you have enough inventory to take care of the *Pennsylvania* and the *West Virginia*. Is that what that means?

Admiral COOPER. Yes, sir, that is correct.

Senator WIRTH. Then you are saying no decision has to get made until December. Tell me what that means.

Admiral COOPER. That means that if Rocky Flats comes on line before December then we continue on just the way we have.

[Deleted.]

Senator WIRTH. And what does [deleted].

Admiral COOPER. [Deleted.]

Senator WIRTH. Now what are the implications of that for the counting in START? Maybe you have been through this.

Admiral **Cooper**. No, sir. The implications are that they would still count for eight.

Senator **Wirth**. [Deleted.]

Admiral **Cooper**. That is correct. The other aspect is that once the START agreement is signed, you still have 7 years to fully adhere to the START agreement, but it really does not play into this particular discussion.

Senator **Wirth**. Why did you bring that up, that we have 7 years to adhere to the START agreement?

Dr. **Crouch**. There is really no limitation. You can have no more. I should say that the D-5 missile for us would count at eight. If you carry a warhead loading of four on it, it has virtually no effect on the treaty whatsoever.

Senator **Wirth**. When do you get to a point where you can no longer [deleted].

[Deleted.] What is the point where Rocky Flats would have to go into production? Is there kind of a drop-dead time on this, or do you just adapt as you go along?

Admiral **Cooper**. Basically, we would adapt as we go along. I would like to give that to Admiral Malley, if I may. He is the program manager. I will let him discuss it.

Admiral **Malley**. You get into a question of when would they restart. You go 1, 2, 3, 4, 5, many, many years. We have not really looked more than about a year or so in advance at this. If there is a prolonged cessation of activities out there, [deleted] we would probably start earlier with loading Trident IIs with the Mark-4s, which was our original plan anyway.

Senator **Wirth**. Which is in your original plan?

Admiral **Malley**. It was in our original plans in the future to start putting on the Mark-4 warheads. We would take them off the retiring C-4s as the old C-4 boats retire.

Senator **Wirth**. Let me understand the syntax here. You say it was in your original plan.

Admiral **Malley**. Still is in our plan.

Senator **Wirth**. So your initial plan for the Trident II was to use Mark-4s; is that right?

Admiral **Malley**. The Trident II was designed to handle both the Mark-4 and the Mark-5. Because we have sufficient Trident C-4s at sea with Mark-4 reentry bodies on it—and those are what we would call your soft target vehicles—there are plenty of those out there. As they start retiring, it turns out that we do not need a full fleet of Trident IIs with Mark-5 warheads on them.

The plans were to eventually get to about a 50/50 mix as the old C-4s retire. So if [deleted] you are going to get to the point where you are going to have to start putting Mark-4s out there. We would take Mark-4s off the Trident I C-4s and just start introducing them to the fleet earlier than we would have under our original plans.

So we will always have reentry bodies for the Trident IIs.

Senator **Wirth**. And the Mark-4s do not have the hard target capability that the Mark-5s do?

Admiral **Malley**. [Deleted.] With the accuracy we are having on Trident II, it is much, much better, but JSTPS would probably not use it [deleted].

Senator **Wirth**. They would not use which one?

Admiral **Malley**. They would not use the Mark-4 for [deleted].

Senator **Wirth**. How many Mark-4s? Is there a very broad inventory of Mark-4s?

Admiral **Malley**. There will be, as the Trident I missiles with the Mark-4s on them and the old Poseidon submarines with the Mark-4s on them are retiring. We will have plenty of Mark-4 assets.

Senator **Wirth**. Let me see if I understand this, in summary. If somebody were to come in and say to us that there is a national security imperative that Rocky Flats be opened tomorrow or Rocky Flats be opened in the next 2 months or 4 months, the answer to that is that in fact there are plenty of Mark-5s now for the *Pennsylvania*, that if we do not open Rocky Flats [deleted] is that right?

Admiral **Malley**. Approximately.

Senator **Wirth**. And then if Rocky Flats is not open at that point then you go to the use of Mark-4s, which exist, I do not want to say in abundance but there is an adequate inventory of Mark-4s?

Admiral **Malley**. But then you start losing your hard target coverage that the JSTPS has planned on.

Senator **Wirth**. That is a whole other set of issues as to what is necessary in terms of the whole targeting capability.

Admiral **Cooper**. And the availability of the Mark-4s depends upon our deactivating and decommissioning those particular submarines that carry those. So there is an expense. Once you start to the point of shifting into the C–4, there is an extra expense in there. But we have a plan.

Senator **Wirth**. What is the extra expense?

Admiral **Cooper**. This is buying new equipment necessary to make that change.

Senator **Wirth**. If you are making that change, how much would it cost you over the next 4 years?

Admiral **Malley**. What you are doing is accelerating costs, not additional costs, because you were providing that equipment anyway. It is about $70,000 a missile, as I remember.

Senator **Wirth**. So the additional cost is in the neighborhood of how much altogether? How many missiles are we talking about?

Admiral **Malley**. That is the unknown. I do not know how many missiles we would eventually use.

Senator **Wirth**. Over the next 4 years, what would you be using—40 missiles?

Admiral **Malley**. It is a variable, depending on how many Trident IIs you want to have with Mark-5s on it and how many you want to download to make up other assets.

Senator **Wirth**. Let us assume that Rocky Flats is not open and you are not going to get any more Mark-5s for a period of time, so you are going to have to adjust. I mean, are we talking about 40 missiles at $70,000 apiece or 200 missiles?

Admiral **Malley**. I am just trying to see if I have a chart with me that takes me all the way through that. I do not have the charts from when we started looking at all these different missiles you have.

There is a point at which, as you have only missiles and warheads [deleted] and if you start having to get Mark-4s what you do is take existing submarines that are deployed before their retirement and take Mark-4s off of deployed assets to further reduce the coverage in that area, to make up for what you are putting on the Trident II.

So there is a need to get Rocky Flats going.

Senator **WIRTH**. You are talking about additional cost of $70,000 a missile. That was one of the variables. About how many missiles would we be talking about over the next 4 years? Is 200 a good ballpark?

Admiral **MALLEY**. Probably not more than three submarines' worth, if you did it, I would imagine. So you are talking probably 72 missiles, three submarines' worth, something like that.

Senator **WIRTH**. So that is an extra $5 million?

Admiral **MALLEY**. That is an advancement of cost. We are going to buy those parts anyway.

Senator **WIRTH**. So the extra cost is in fact $5 million and we are talking right now about $600 million for building this 371, Mr. Chairman. I know you are looking for money in your budget. That is the reason I am pursuing these dollar amounts, to find out what it is that we are talking about here in terms of additional cost and where we can find money.

Everybody is coming after money in your budget. Admirals, thank you very much. I appreciate you all being here. Thank you, Mr. Chairman.

Senator **EXON**. Thank you, Senator Wirth. I listened with great interest to the exchange here, and indeed we are looking in every nook and cranny, which leads me into the last question that I have of the panel.

I will direct this question to you, Admiral Malley, and if the other members of the panel wish to comment on it, we would be glad to hear their views also.

Last year, Admiral, the staff calculated that just since fiscal year 1985 alone the Navy has reprogrammed at least $650 million from the overall Trident submarine program. The reprogrammed funds cited have come from those authorized before the fiscal year 1988–1989, presumably because it is not until the construction effort is under way for several years that the magnitude of the excess funds becomes apparent.

Moreover, since the Navy has been procuring Trident submarines since the mid-1970s, the continued excess of funds cannot be attributed to a learning process on a new program where costs are not well understood. What is the Navy's explanation, then, for these continuing large reprogrammings from the Trident program?

A follow-on question is why should Congress believe that the requested amounts reflect the actual requirement?

Admiral **COOPER**. Could I please answer that, if I may?

Senator **EXON**. Certainly, Admiral.

Admiral **COOPER**. Having been budget officer of the Navy about 1985 or so, several things happened, and I do not know exactly which ones we are talking about here. I know you are talking about several appropriations.

One interesting aspect is I think in 1985 there was an amount of about $250 million that was reprogrammed out of the SCN line. It turns out a great deal of that was for the *Tennessee*. The *Tennessee* was the one that we put into the D–5, made it the first D–5 submarine. It turned out that we had estimated—and of course you estimate 3 to 4 years before you get to the point where you finally sign the contract—two things.

We estimated that it cost more to insert into the submarine than it did. But the second thing that even gave us more money, a larger percentage of that $250 million was in fact inflation indices, and that was the time at which we were estimating with larger inflation indices than in fact came in.

So, as you start building the submarine, and you get your return on costs and the inflation is not as high as you thought, then that money becomes excess and therefore, available. When you have some other need for it, you take that and you come to Congress and you say we want to do this and therefore we ask that you approve.

I think if you will look across the other procurement, Navy, or OPN, which also represents some of the monies that you are talking about within the whole program, possibly some was in R&D, but I think those are the three major appropriations. What you will find is that the contracts that we signed as we went along in fact, whether it was through competition or whatever, maybe came in at slightly less.

Therefore, once we either got return costs or signed a contract where we knew what the final cost of that particular item would be, then the Navy, as they look into executing their programs that they tried to estimate 3 or 4 years earlier, will find that there is money over here where over on this side there is not any money.

And so we will come in with reprogrammings and say we would like to take money from here and put it over here to properly execute the program. That is a normal budgetary process that we go through.

As you look into where we are now, we too are very interested in saving money, so we see the return costs from 1985, 1986, 1987, whatever, and we say, hey, it did not cost that much money back then, therefore, we are not going to estimate quite that high this year. And we have tried to scrape it down as far as we can.

The other thing is the inflation indices these days, the inflation we see, is much higher than that for which we have been allowed to account as we do this estimation. And the inflation indices that we have put in, they are not something that we, the Navy, dream up ourselves; they are something that is given to us by OMB and OSD, and they say no matter what it is you are buying, Navy, or where you are buying it, these are the indices that you will use.

So, there is a system in there that is very difficult as you try to adjust in the very elaborate Navy budget. It is a very logical way, and I am sure I could sit down with each and every thing that has been mentioned or that would be mentioned and tell you wherein that was done. But that is the overall general answer to your question.

Senator Exon. This question then naturally follows. Will the Navy request approval for reprogramming from the Trident procurement line in the current fiscal year?

Admiral Cooper. My guess would be absolutely not. My guess is we are tight as a tick.

Senator Exon. So you know of no plans or no funds that would be available for reprogramming?

Admiral **Cooper**. I know of no funds that we would be able to take out of the Trident program at this time, because you may recall when we did the various tests on the improvements that we had been making on the D-5 missile because of the first problems, that in fact cost some money and we are looking now to see where that money will come from.

I am certain that we will not come in and offer up in the Trident line this year. But, you know, we may offer up some Trident from last year or whatever. Anyway, we are tight as can be, I think.

Now, if the gentleman on your right is about to give you a piece of paper that shows that I have just lied to Congress, I hereby apologize and will try to take that for the record. [Laughter.]

Senator **Exon**. I am just advised, as you had anticipated—certainly we are not accusing you of not telling the truth, and I want to clear that out—the Navy is officially talking about reprogramming some $78,000,000 from the Trident program. Do you not know about this reprogramming?

Admiral **Cooper**. I do not know about it. That is correct, and I would like to look specifically at what year we are talking about, which Trident hull we are talking about, which accounts we are talking about. It gets very complicated. But I would certainly be glad to take that.

Senator **Exon**. Let me advise you where $78,000,000 would come from, according to the figures that we have from the Navy: $15,000,000 from fiscal year 1985, $10,000,000 from fiscal year 1986, and $53,000,000 from fiscal year 1987.

There is a whole series of these things that I think it would be best if we asked you to comment on and answer for the record so we would have that information.

Admiral **Cooper**. Yes, sir. I will be glad to.

[The information follows:]

A review of the current reprogramming status for TRIDENT Submarine accounts show the following:

Ship Conversion, Navy (SCN)

Fiscal Year (FY):	amount ($ millions $)
85	-345.2
86	-105.1
87	-84.3
88	-10.0
89	-19.4
90	0.0
total	-564.0

Other Procurement, Navy (OPN)

Fiscal Year:	amount ($ millions $)
87	-47.6
88	-67.1
89	-54.6
90	0.0
total	-169.3

The -$733.3M total is the most recent data available, showing a difference between the -$650 million reprogramming mentioned, which is a year old.

Assets have become available for reprogramming over the years due to several factors. The large amounts in fiscal year 1985 and fiscal year 1986 were due to costs of contract execution which came in lower than what was estimated at the time of budget formulation. Other assets were largely available due to published inflation indices which overestimated actual costs.

The $78,000 in Senator Exon's remarks refers to the $78,000,000 considered by the Navy for the fiscal year 1989 SCN Ship Cost Adjustment (SCA). Results of that action are as follows:

Fiscal Year:	resolution
85	$15M reprogrammed, which is included in the previous discussion.
86	$10M considered. No action was taken.
87	$70M considered, but this was transferred to the FY90 account via the FY90 appropriations act.

Senator EXON. When you brought up the matter of the additional cost that the Navy incurred with regard to the D-5 difficulties, was that failure of the D-5 not living up to its expectations primarily the responsibility of the Navy or the contractor or both?

As I understood that, given the explanation that was given to me at the time, all the computer tests and models indicated that it would have stability as this larger missile was launched, but as it turned out, that was not the case.

Admiral COOPER. That is right. Let me ask Admiral Malley to answer this.

Senator EXON. And given that, my question goes back to the situation that we run into all the time when we have cost overruns. Is that partly or totally the responsibility of the contractor, and can you enlighten us as to how much of the costs were borne by the contractor or if none of them were borne by the contractor?

Admiral MALLEY. Let me start by answering your question of whose fault it was.

Dr. CROUCH. Don't say OSD. [Laughter.]

Admiral MALLEY. As far as the fault is concerned, I would have to say the fault would probably go with both parties, and I say that because I was there at the initiation of the contract for Trident II D-5. And there were extensive discussions as to whether or not we should invest somewhere between $700 million to $1 billion on an underwater test facility to test the Trident II D-5 system in the launch environment before you launched from a submarine.

It was the Navy's decision, and probably my decision since I was then the technical director of the program, that given the amount of information we already had on launching the C-3s and C-4s, which is a similar missile with a single first stage, that that cost certainly did not appear warranted, and I had difficulty in my mind defending that to the people not only in the Navy but in OSD and perhaps in Congress to set up an extensive underwater test facility, given the knowledge we had.

Given the sub-scale tests and everything else, we had no idea of what the problem was. So, it was not until we actually tested it and then even had the second failure with extra instrumentation before we really understood what was happening.

There were no textbooks, no laws of physics or anything else that we needed to understand what happened. So the culpability is really, I would say, joint.

With respect to the contract itself on Trident, I will have to get you the exact numbers for the record, but we were anticipating at the time of that first failure an underrun. We were going to come out as an underrun. As it is, there is a small amount of funds that the contractor could not come up with as a result of the failure. And that cost about $125 million, roughly, for that, and most of those funds were made up by the underrun we were anticipating.

In addition, throughout the years we had our budgets reduced somewhat to the point where the money we were going to set aside for incentive fees were not all available. Now we are working within the Navy to try and figure out how to fund the incentive fees for that contract where Lockheed, who was the subsystem contractor, exceeded many of the areas. He is going to lose some money on cost because of the failure and the eventual overrun on what he had. I will have to get those for the record and provide it, but I just do not have those with me.

But when you consider the contract that we have is about a $6.5 billion contract covering a period in excess of 6 years, we will have missed the target by less than one-half of 1 percent, which is not too bad.

[The information follows:]

The Navy's multiple year, annually funded contract with Lockheed Missile and Space Company (LMSC) for the TRIDENT II (D-5) missile development and initial production is a Cost-Plus Incentive Fee contract. Contract costs are structured on a 90 percent/10 percent basis; the government benefiting from or contributing to any cost variance on a 90 percent basis. The difference in cost between the projected underrun prior to the test failures and the current projected overrun is approximately $118 million. This change in cost will result in a fee reduction to LMSC of $11.8 million from the negotiated profit based on their 10 percent variance cost share.

In addition to the effect of cost on fee, the contract is heavily incentivized to maximize missile performance, including range, reliability and quality. Out of a total contract cost of approximately $5.4 billion, LMSC is projected to earn approximately $150 million in above-target performance incentive fees.

Senator EXON. Are you telling me, then, that it did not cost the contractor anything?

Admiral MALLEY. No. He will lose some money because he exceeded some thresholds, and I just have to figure out what those numbers are. But again the total cost was $125 million and most of that was funded by the underrun he was already anticipating.

Senator EXON. You are saying, then, Admiral, if I understand it correctly, that you made a calculated risk to save money for underwater tests, that looking after the fact it is easy to make decisions after the fact, but looking back at the time you felt that we could save some money on the overall program because those underwater tests were not justified by the previous experience that you had had. Is that right?

Admiral MALLEY. Yes, sir, and in fact we probably saved about $0.5 billion by not running those tests.

Senator EXON. In other words, in the long run, the total cost of the program was less even though we could probably have better assured full-scale success on the first missile had we taken the other route, but it would have cost us more. Is that right?

Admiral **Malley**. Yes, sir.

Senator **Exon**. Gentlemen, I thank you very much. I think that is all the questions we have today. Once again, we hope that you will answer the questions for the record and the specifics for the record that you said you would provide on these various matters that we just discussed.

So, with that, I thank you very much for being here. It was a very informative hearing, and we are adjourned.

[Questions for the record with answers supplied follow:]

QUESTIONS SUBMITTED BY SENATOR J. JAMES EXON

Senator **Exon**. In your statement, on page 5, you assert that "there is no scientifically plausible prospect for an ASW technology breakthrough which would provide a basis for a threatening attack on our SSBN forces through the 1990s and probably well beyond."

Are you even slightly disturbed by the results of DARPA's experiments in Scotland last year? Is absolute confidence warranted when the Soviets have deployed some non-acoustic sensors [deleted].

Admiral **Cooper**. The DARPA test conducted in Loch Linnhe, Scotland last year did not in any way change our confidence in the security of the SSBN forces. In fact, the DARPA test gave further confirmation of our scientific understanding. The test did produce new results not yet well modelled. These new test data form the basis of ongoing research by the Navy and the Central Intelligence Agency that will lead to a more precise understanding and modelling capability.

With respect to the Soviet NAASW systems mentioned, it is [deleted].

Senator **Exon**. The director of Naval Intelligence, Rear Admiral Brooks, writing in the *Naval Institute Proceedings* on a recent Soviet book on Soviet naval missions, stated that this book "openly and forcefully espouses strategic ASW as a primary role of the Soviet Navy." Admiral Brooks quotes from the book that "strategic ASW may be elevated to the level of a national mission" for the Soviet Union. Admiral Brooks notes that this Soviet book explicitly refers to space-based surveillance systems that would contribute to this mission. Should we be concerned about these Soviet statements? Would prominent Soviet writers be making such provocative statements during this period of detente if they weren't serious?

Admiral **Cooper**. Such statements are indeed cause for concern and reflect the convictions of Soviet writers. For this reason, [deleted]. The following points are germane:

— As Admiral Brooks pointed out, the missions to which the Soviet book refers are not new ones for the Soviet Navy. Existing missions have been reprioritized, with defense of the homeland against seaborne threats (to include missile carrying submarines) assuming top priority over strategic attack mission which is now ranked second. In essence, a "defensive" mission has replaced an "offensive" one as the top priority consistent with the Soviets' proclaimed defensive doctrine.

— The book's authors accept the fact that strategic ASW is a formidable task, as Admiral Brooks noted in his article. While the authors maintain that significant, if partial success is likely, they provide no specifics on how the mission will be accomplished. The authors frequently speak about future capabilities as though they were in the fleet today, a common characteristic of Soviet writings.

Thus, while we are concerned about the statements, our ongoing intelligence and security program efforts are focused on close monitoring of Soviet developments. [Deleted.]

Senator **Exon**. According to the SSBN Security Program Office, [deleted].

What are your views on the value of continuing laser communications technology efforts? Does the Navy intend to begin budgeting for a technology program? Will the Navy/DARPA JADE program provide useful technology for a submarine communications capability? If the Navy does not intend to pursue laser technology, how will the Navy address the [deleted] problems discussed above?

Admiral **Cooper**. The Navy recognizes the need for an ability to communicate with submarines at operational depth and speed. The Navy has been unable to commit to a Satellite Laser Communications (SLC) program until the basic engineering issues are better understood and the life cycle costs are reduced. Funding for an SLC system has been estimated to be \$1B–\$5B depending on satellite coverage and method of employment. A new focus on solid state laser and receiver technology by the Navy and DARPA has the possible potential of providing a cost effective SLC system for the future.

Navy is monitoring the DARPA effort to develop and demonstrate matured technology to field an affordable system. Once the high technological and engineering risks associated with the project are solved and costs reduced, the Navy will integrate the SLC capability into the overall communication system network.

[Deleted.]

QUESTION SUBMITTED BY SENATOR STROM THURMOND

TRIDENT WARHEADS

Senator **THURMOND**. Dr. Crouch and Admiral Cooper, in his answer to an earlier question by Senator Wirth, Admiral Malley indicated that the Navy will be able to field Tridents with C-4 warheads even if the DCE fails to deliver the D-5 W-88 warheads in time. It might appear, then, that the C-4 warhead would satisfy military reguirements—otherwise the Navy would not deploy it. Therefore I want to ask very clearly: Will all military hard target requirements be met if the D-5 warheads are not delivered in time?

Dr. **CROUCH**. The Department of Energy (DOE) has not advised us that they cannot build sufficient warheads to meet the deployment schedule for the third D-5 submarine—the U.S.S. *West Virginia*—scheduled for completion next year. In fact, Admiral Watkins continues to believe that production can resume within the weapon production complex this summer. If so, there should be little impact to the *West Virginia's* deployment schedule with a full load of missiles and warheads.

Nevertheless, we have examined a few alternatives in order to equip deployed missiles with warheads should the facility remain in standby beyond DOE's current estimate. Projections of the outage will determine our course of action. [Deleted.]

Each of these alternatives is highly undesirable from a policy and capabilities standpoint. Although each solution is preferable to simply not deploying new construction Trident submarines, neither can serve as a substitute for reopening the plant at Rocky Flats.

The deployment of the D-5 with Mk 5s provides a survivable and enduring hard target capability which significantly increases the flexibility of the SLBM force. That capability enables the sea-based leg of thee Triad to strike effectively—for the first time—virtually the full spectrum of installations in the target system. In turn, a fully deployed D-5/Mk 5 force will afford the United States the capability to hold at risk Soviet assets with a smaller, more efficient and cost effective SSBN force.

Senator **THURMOND**. Dr. Crouch and Admiral Cooper (I would prefer an answer from each of you), in his answer to an earlier question by Senator Wirth, Admiral Malley indicated that the Navy will be able to field TRIDENTs with C-4 warheads even if the DOE fails to deliver the D-5 W-88 warheads in time. It might appear, then, that the C-4 warhead would satisfy military reguirements—otherwise the Navy would not deploy it. Therefore, I want to ask very clearly: Will all military hard target requirements be met if the D-5 warheads are not delivered in time?

Admiral **COOPER**. The Trident II (D-5) missile with Mk 5 (W-88) warheads was designed to allow the SLBM leg of the Triad to hold the entire spectrum of Soviet targets at risk, including hard targets. The Mk 5 warhead enables the United States to hold hard Soviet targets at risk from a survivable, enduring platform. Additionally, as Poseidon SSBNs (equipped with C-3 and C-4 missiles) are retired we may not have the planned capability to replace them.

To make the best of a bad situation, Mk 4 warheads could be deployed on the Trident II missile earlier than originally planned. However, it would be operationally and strategically preferable to equip them with Mk 5 warheads. Given a choice between deploying Mk 4 warheads on the Trident I (C-4) missile, as is currently done; or the Trident II (D-5) missile, the increased accuracy and range capability of Trident II make it the logical choice.

While I want to see production of the W-88 warhead resume as soon as possible, it should be done prudently and within the framework of DOE's institutional restructuring.

QUESTIONS SUBMITTED BY SENATOR JOHN MCCAIN

STRATEGIC NUCLEAR TARGETING

Senator MCCAIN. What targets covered by the Peacekeeper, Small ICBM, or Minuteman cannot be covered by the D-5? What specific scenarios would these differences in capability affect?

Dr. CROUCH. [Deleted.]

Each leg of the Triad possesses unique attributes, however, which make them more or less suitable for assignment to certain targets over others. For example, the ability of the ICBM leg to respond promptly to an attack makes it a more effective leg against time urgent targets than the SLBM or bomber legs, whereas the bomber and SLBM legs can be used more effectively against targets which are not time urgent in nature. In addition, each leg of the Triad serves as a hedge against the failure of either of the other legs of the Triad, thus assuring our ability to respond to an attack, and strengthening deterrence.

STRATEGIC NUCLEAR COMMUNICATIONS

Senator MCCAIN. What command, control, and communications capabilities exist in the ICBM force that do not, or cannot, exist in the Trident force? What specific scenarios would these differences in capability affect?

Dr. CROUCH. The only difference in the command, control, and communications (C3) capabilities for different legs of the Triad resides in the supporting communication systems. The ICBM force utilizes the following communications systems that cannot be used by Trident:

[Deleted.]

The differences in communication systems noted above would not be fundamentally altered by varying attack scenarios. Although some of the communication systems would be degraded or destroyed by an attack, the redundancy of systems for each of the legs of the Triad ensures that connectivity to the forces would be maintained even after an attack. The differences in the characteristics of the forces themselves, however, and the media they transmit in, make them more or less prompt, survivable, recallable, flexible, and capable in certain scenarios and against certain targets.

STRATEGIC NUCLEAR TARGETING

Senator MCCAIN. What targets covered by the bomber force cannot be covered by the D-5? What specific scenarios would these differences in capability affect?

Dr. CROUCH. [Deleted.]

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Senator MCCAIN. What command, control, and communications capabilities exist in the bomber force that do not, or cannot, exist in the Trident force? What specific scenarios would these differences in capability affect?

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Senator McCain. What measures are currently used to compare the survivability of the Trident force with that of given types of manned bombers, silo-based ICBMs, and mobile ICBMs? What are the resulting comparisons?

Dr. Crouch. Many factors influence the survivability of the various strategic legs, and each system is looked at individually to determine survivability. Survivability is determined by looking at such factors as dispersal area, silo hardness and location, expected technological advances in Soviet ASW and submarine operating habits.

[Deleted.]

Senator McCain. What is the estimated life cycle cost of each Trident warhead under the current program? How does this cost compare with the projected life cycle cost of each bomber warhead carried by the B-1B, B-2, Rail-Garrison MX, and mobile SICBM?

Dr. Crouch. When estimating life cycle cost per warhead it is important to note that the conclusions are sensitive to: (1) changes to the procurement schedule, and (2) changes to the number of units deployed. The estimated life cycle cost per warhead shown below (in fiscal year 1990 $M) takes into account RDT&E, procurement, and MILCON associated with acquisition or modification of the system, plus 30 years of operations and support. Only costs incurred in fiscal year 1990 and beyond were considered in computing the costs for each system:

[Deleted.]

STRATEGIC NUCLEAR FORCES

Senator McCain. What are the comparative advantages and disadvantages of emphasizing a Trident force versus an ICBM and/or bomber force in a Post-START environment? And:

What are the comparative advantages and disadvantages of moving toward a dyad of manned bombers and Tridents in a post-START environment?

Dr. Crouch. We will seek to balance the various characteristics and relative advantages inherent in each leg of the Triad in a post-START force. Each leg of the Triad contributes uniquely to our capabilities and our ability to deter. For example, the ICBM force is capable of responding more promptly than either the SLBM or the bomber force. Under some scenarios, the SLBM leg, however, is more survivable than today's ICBM force. The bomber leg of the Triad is the only leg that, once launched, can be recalled. In addition to unique characteristics, the presence of three Triad legs ensures perhaps the most fundamental requirement for deterrence: that enough forces survive a worst case scenario of a surprise attack to effectively mount a retaliatory second strike. Furthermore, three different system types complicates Soviet attack planning and Soviet defenses: U.S. forces would attack from multiple azimuths at varying times. Each of the three legs of the Triad, therefore, complements the others and contributes to a more robust nuclear deterrent than would be possible with a dyad or monad of forces.

[Whereupon, at 3:55 p.m., the subcommittee adjourned.]

DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEAR 1991

WEDNESDAY, MAY 23, 1990

U.S. SENATE,
SUBCOMMITTEE ON STRATEGIC FORCES
AND NUCLEAR DETERRENCE,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

DEPARTMENT OF ENERGY BUDGET REQUESTS

The subcommittee met, pursuant to notice, at 2:38 p.m., in room SR-253, Russell Senate Office Building, Senator J. James Exon (chairman of the subcommittee) presiding.

Committee members present: Senators Nunn (chairman), Exon, Levin, Bingaman, Gore, Wirth, Warner, and Thurmond.

Committee staff members present: Madelyn R. Creedon, counsel.

Professional staff members present: William E. Hoehn, Jr., T. Kirk McConnell, and Michael J. McCord.

Minority staff members present: Patrick A. Tucker, minority staff director and counsel; Brian D. Dailey and George W. Lauffer, professional staff members.

Staff assistants present: Mary J. Kampo, Cindy Pearson, and Mickie Jan Wise.

Committee members' assistants present: Andrew W. Johnson, assistant to Senator Exon; Kenneth N. Luongo, assistant to Senator Levin; Christopher E. Paine, assistant to Senator Kennedy; Edward M. McGaffigan, Jr., assistant to Senator Bingaman; John Gerhart, assistant to Senator Bingaman; Milton D. Beach, assistant to Senator Glenn; Leon S. Fuerth, assistant to Senator Gore; Jefferson B. Seabright, assistant to Senator Wirth; Terence M. Lynch, assistant to Senator Shelby; Robert M. Soofer, assistant to Senator Gorton; and Charles G. Pearcy, assistant to Senator Lott.

OPENING STATEMENT OF SENATOR J. JAMES EXON, CHAIRMAN

Senator EXON. The subcommittee will please come to order. The Subcommittee on Strategic Forces and Nuclear Deterrence meets today to receive testimony from the Department of Energy on its budget request for fiscal year 1991. We have invited all members of the committee to come today and hear the important testimony that we are going to have. After we have finished this open session, we will go to room SR-222 for a closed hearing.

Admiral Watkins, the Secretary of Energy, was originally scheduled to testify before the subcommittee this afternoon in both open and closed sessions. Admiral Watkins declined to testify in the open portion of this afternoon's hearing. However, he will testify in the closed session later on. John C. Tuck, the Department of Energy Under Secretary, is here with us this afternoon for the open session.

This afternoon the subcommittee continues its review of the Department of Energy's progress toward restoring defense production operations in an environmentally sound manner, its Environmental Restoration and Waste Management Program, and the Department's budget request for fiscal year 1991.

In our hearing on May 1 we discussed at some length one portion of the challenge faced by the Department of Energy, the Department's restart plan for the Savannah River tritium production reactors, and the Rocky Flats plant. The second portion of the challenge faced by the Department is cleaning up the waste that was generated and stored in the past, while, at the same time, managing the waste generated today.

Another issue of concern to this subcommittee and to the full committee is the nuclear weapons safety problem. This morning's Washington Post contains a very interesting article on this subject. Because this subject is of continuing concern, we would appreciate any comments you might have on this article.

Admiral Watkins has stated that health, safety, and environmental issues are on equal footing with production issues and that the Department is committed to environmental restoration in compliance with the applicable environmental regulations and more cooperative relations with the host States and regulatory agencies. We certainly applaud these goals.

The start of the Department of Energy's Environmental Restoration and Waste Management Program in August of 1989 is a 5-year plan. The subcommittee is concerned, however, that the Department's budget and planning process adequately address the many environmental issues facing it so that the Department can achieve the goal set by Admiral Watkins, to be in full compliance with all environmental laws and compliance agreements.

Estimates of the cost to clean up the Department of Energy's production complex range from $65 billion to $125 billion. And yet, the Department of Energy's fiscal year 1991 budget request for defense-related environmental restoration activities, corrective action, is only $775 million. This is 7 percent of the total Department of Energy request for fiscal year 1991 with regard to atomic energy and defense activities. At the current rate of spending, unfortunately, the Department will spend the better part of the next 100 years cleaning up the weapons complex if the clean-up costs fall within the $65 to $125 billion estimate range.

The Senate Budget Committee has indicated the shortfall for the environmental cleanup is about $603 million. Waste management activities, like environmental restoration, are an integral and important aspect of the Department of Energy's ability to carry out its weapons and nuclear materials production. Good waste management practices today ensure that our children and grandchildren do not have the burden of cleaning up the waste that we have generated in the past and up until this date.

On the other hand, environmental considerations should not eclipse production goals. In response to questions Senator Thurmond and I sent to the Department of Energy in April in preparation for today's hearing, Admiral Watkins expressed his commitment to and confidence in the Department's ability to "produce defense nuclear materials without jeopardizing the environmental safety or health concerns." Admiral Watkins also cautioned, however, that "some environmental requirements, such as the RCRA land disposal restrictions, are complex, and will require considerable time and resources before full compliance is possible." This subcommittee urges that the States, the Environmental Protection Agency (EPA), and the Energy Department work together to achieve compliance in an orderly and timely fashion.

The open portion of this hearing will consist of one round of questions following Mr. Tuck's opening statement. Additional rounds will be added if my colleagues so desire. We will then adjourn this hearing and continue in closed session 10 minutes later in SR-222.

Let me now call upon my distinguished colleague and friend, Senator Strom Thurmond, the ranking member of the Subcommittee on Strategic Forces and Nuclear Deterrence, for any opening remarks that he might have. Senator Thurmond.

Senator THURMOND. Thank you very much, Mr. Chairman. Mr. Chairman, I want to associate myself with your remarks and join you in welcoming Secretary John Tuck. He is familiar to us all and in my judgment has borne up well under the tremendous burden that he must carry. We feel he is doing a fine job.

Mr. Chairman, you and I have witnessed firsthand the changes initiated in the Department of Energy under the leadership of Secretary Watkins. I believe he has taken on the tough issues facing our nuclear weapons production complex. The Department of Energy and its contractors have made significant progress over the past year in resolving the safety and environmental problems that have plagued the complex. We can finally see the light at the end of the tunnel with regard to the restart of the reactors at the Savannah River site and the opening of the Waste Isolation Pilot Plant.

Despite the progress, the real test lies in the future. This summer the Department will unveil its Environmental Restoration and Waste Management 5-Year Plan. The credibility of the Department hinges on this important document and the funding support which Congress will provide to carry out the plan. The $2.4 billion requested for fiscal year 1991 is only a small down payment on the total environmental clean-up bill. I hope we will keep in mind that cleaning up our past mistakes is an investment in the health and welfare of the next generation and deserves our full support.

Concurrent with environmental restoration is the building of the New Production Reactor. Despite the pending restart of the reactors at Savannah River later this year, the useful life of these reactors is only 10 years. At the end of that period, we need to have in place a modern, safe, and environmentally clean reactor. The plan outlined by the Department of Energy for the New Production Reactor will achieve that goal.

Over the past 45 years our nuclear weapons complex has provided the Nation a credible deterrent against aggression. I expect that, although our reliance on large numbers of nuclear weapons will diminish as we enter the next century, we will always have a need to maintain a safe, reliable, and modern deterrent. Secretary Watkins has outlined a plan which will allow us to build and develop those weapons and, at the same time, resolve the environmental problems.

Mr. Chairman, the Secretary and the people at the Department of Energy deserve our support and the funding necessary to carry out the missions which Congress and the Nation have given to them. I know that, under your leadership, this subcommittee will provide that support. Thank you, Mr. Chairman.

Senator EXON. Thank you, Senator. We appreciate your statement very much.

Mr. Secretary, welcome once again. We have no prepared statement from you but I assume that you have a statement to make today. If you do have an extended statement, I would appreciate it being offered for the record. If not, please proceed in any fashion you see fit. Then we will proceed with our questions.

STATEMENT OF HON. JOHN C. TUCK, UNDER SECRETARY OF ENERGY; ACCOMPANIED BY VICTOR STELLO, DEPUTY ASSISTANT SECRETARY OF ENERGY FOR FACILITIES; REAR ADM. MICHAEL BARR, DEPUTY ASSISTANT SECRETARY OF ENERGY FOR MILITARY APPLICATION; STEVE RICHARDSON, DEPUTY ASSISTANT SECRETARY OF ENERGY FOR NUCLEAR MATERIALS; DOMINIC MONETTA, DIRECTOR OF THE OFFICE OF NEW PRODUCTION REACTORS, DEPARTMENT OF ENERGY; LEO DUFFY, DIRECTOR OF THE OFFICE OF ENVIRONMENTAL RESTORATION AND WASTE MANAGEMENT, DEPARTMENT OF ENERGY; AND STEVE WAKEFIELD, GENERAL COUNSEL, DEPARTMENT OF ENERGY

Mr. TUCK. Thank you, Senator Exon, and thank you, Senator Thurmond, for those kind remarks. Mr. Chairman and members of the committee, I am pleased to appear before you today in support of the Department of Energy's fiscal year 1991 authorization request of $11 billion for our national security programs.

Secretary Watkins provided the Department's position on a number of current issues during his appearance before you on May 1. At that time Secretary Watkins submitted a comprehensive and formal statement for the record. He asked me to come before you today to continue those discussions in greater detail that were initiated on the first of May. I would like to make a brief opening statement and then respond to any questions from the committee. Admiral Watkins will appear before you, as Senator Exon has indicated, later in closed session to discuss classified matters.

I wish to note that I am responsible to the Secretary for the Department's national security programs. These include the Defense Programs activities, in my capacity as the Acting Assistant Secretary for Defense Programs, the New Production Reactors Program, and the defense-related portion of the Environmental Restoration and Waste Management Program in my capacity as Under Secretary of the Department of Energy.

I am accompanied here today by the top key individuals at the Department, and I would like to briefly introduce them. First, Steve Wakefield, General Counsel; Leo Duffy, Director of the Office of Environmental Restoration and Waste Management; Vic Stello, Deputy Assistant Secretary of Defense for Facilities; Rear Adm. Michael Barr, Deputy Assistant Secretary for Military Applications; Steve Richardson, Acting Deputy Assistant Secretary for Nuclear Materials; Dom Monetta, Director of the Office of New Production Reactors; and Peter Brush, Acting Assistant Secretary for Environmental Safety and Health.

Senator EXON. Mr. Secretary, excuse me, I would just like to interrupt you at this point. We welcome all of you gentlemen and are glad to have you here because your expertise might be needed in some of the questions that will be posed. Just for the assistance of our Recorder, though, you will be the principal witness, Mr. Secretary. If any of the other witnesses are called upon for any explanation, we would ask them to so identify themselves so that the record could be kept straight.

Mr. TUCK. Absolutely. Yes, sir. Our $11 billion budget request for fiscal year 1991 includes $7.5 billion for Defense Programs; $400 million for the New Production Reactor Program; and $2.4 billion for Defense-related Environmental Restoration and Waste Management functions. I would like to ask permission of the committee to include for the record three more detailed statements supporting our budget requests for those major program areas.

Senator EXON. Are you offering those at this time?

Mr. TUCK. If I may, yes, please.

Senator EXON. Without objection, they are accepted and will be placed at the end of your testimony.

Mr. TUCK. Thank you, Senator. The $700 million request for the Naval Reactors Program can be addressed separately if you so decide. For Defense Programs, the request for weapons activities of $4.7 billion and nuclear materials production of $2.4 billion reflects the improvements, particularly with regard to Savannah River and Rocky Flats, in operations in environment, safety, and health areas that the Secretary has directed over the past year. Included in those programs is an initial investment to fix problems identified to date by what we call our "Tiger Teams" and other internal oversight organizations. I will expand on that in just a moment.

The budget, however, does not reflect any force reductions due to potential arms control agreements. I might add that, even if new weapons work is eliminated by START or other agreements in certain scenarios, the overall budget request for defense programs activities could well increase due to the need to transport, store, and reprocess returned weapons and materials in a safe and secure manner.

The budget does not reflect any predeterminations on where we ultimately go with long-term modernization and configuration, but does support the Programmatic Environmental Impact Statement (PEIS) and other support activities leading to a fiscal year 1994 record of decision, as it relates to the modernization commission's recommendations.

Our request includes $363 million for the New Production Reactors Program. The Department's preferred strategy is to proceed with the design and construction of a heavy water reactor at the Savannah River site and to design and construct a modular, high temperature gas-cooled reactor plant at the Idaho National Engineering Laboratory.

Senator EXON. Mr. Secretary, are you suggesting, then, full speed ahead simultaneously with both sites?

Mr. TUCK. That's precisely what I'm suggesting.

Senator EXON. I beg your pardon?

Mr. TUCK. Yes, Senator Exon. That is precisely what I am suggesting.

Senator EXON. Thank you.

Mr. TUCK. As a contingency, work is to continue on the development of a light water reactor tritium target. We are proceeding on an urgent schedule with preparation of an environmental impact statement in parallel with confirmatory development and preliminary design.

Finally, the request includes a large and growing investment, $2.4 billion, in the cleanup of our defense facilities. The request will fund activities necessary to prevent near-term, adverse health and environmental impacts and to ensure that existing compliance or clean-up agreements are maintained. It also includes some additional, lower priority projects, to reduce risk, promote compliance, reduce cost, and prevent disruption of the Department's mission.

Our 5-year planners have been validating the cost estimates of the updated 1992 Environmental Restoration and Waste Management 5-Year Plan. They are matching the requirements that the field offices identify against what we can expect to accomplish. That has taken more time than we had first anticipated. Secretary Watkins expects to authorize release of the updated 5-year plan about a month from now. We will ensure that every dollar that we earmark for cleanup is well-planned and that it makes sense and that we fully account for it.

By and large, our contractors do a responsible job in managing the production aspects of our complex. Nonetheless, I am concerned that in certain areas, such as environment, safety, health, safeguards, and security, that they can, and will, do even better. The Department's historical practice of indemnifying its contractors for all losses and liabilities has not provided sufficient motivation to achieve excellence in these critical areas.

To address this and other issues, a proposed rule was issued on January 26, 1990, which is intended to increase the accountability of our contractors in areas where they have exclusive and sole control. The Department is now in the process of reviewing all of the comments provided during the public comment period for that rule. Since the deliberations are ongoing, I believe it would be inappropriate to comment on the merits of the proposed rule at this particular point and in this forum.

Finally, I want to state that last week the Department announced another proposed rule to increase its current fee levels in order to provide a stronger management incentive for excellence in performance; to adjust the Department's fee schedule for inflation since the last adjustment was made in 1983; and to reflect the new balance between increased risks and rewards. Contractors will be able to assess the impacts of the accountability rule with the gains they may realize from greater award fees.

Last year Admiral Watkins established Tiger Teams to provide a full and current assessment not only of environment, safety, and health problems at our facilities, but, more importantly, of the root causes of these problems. Assessments have been completed at 14 of our sites, including 11 facilities within the nuclear weapons complex. To date, nine draft action plans have been prepared. We found that development of draft action plans also required more time than we originally scheduled due to the extent and complexity of the problems identified.

There are now revised dates for submission of the final action plans to the Secretary for approval. I believe our letter to Senator Glenn of yesterday, and other Members of Congress, stated the current status of our plans. The current dates for submittal to the Secretary are: Portsmouth, May 30; Fernald, June 11; Rocky Flats, June 20; Nevada Test Site, June 21; Savannah River, July 2; Pantex, July 13; Y-12, July 20; Mound, August 9; and Kansas City, August 31. The Pinellas plan should be completed in September, with the Lawrence Livermore and Sandia-Livermore plans to be completed in October.

I want to emphasize that the Department is not waiting for the action plans to be finalized before moving ahead. We are already addressing the critical items that have been identified. I should point out, however, that implementation of these action plans will have significant budget impacts. While the draft action plans will contain preliminary estimates of cost, we will have to review those requirements to determine the proper mix of funds, trade-offs, or potential need for amended or supplemental requests.

Now, to the Rocky Flats resumption issue. Operations at the Rocky Flats plant have been suspended to allow the contractor, EG&G, to gain a comprehensive understanding of the plant conditions and operations and to implement a number of operational improvements leading to a more formal and disciplined approach to plutonium facility operations. Our contractor, EG&G, presently supports a schedule which will result in their readiness for resumption of operations for the first two buildings by mid-June. Representatives of EG&G provided the Committee staff with briefings on the progress made to date and their ability to resume plutonium operations. Briefings last week by EG&G suggest now that this date will slip, probably to the end of June.

I want to emphasize that the Department and Admiral Watkins have not yet fully reviewed, nor approved, the EG&G schedule. The Department, the Defense Nuclear Facilities Safety Board, and the Advisory Committee on Nuclear Facility Safety are currently reviewing this EG&G information.

I might add that SCIENTECH, which is a technical support contractor, has recently completed its independent assessment of EG&G's efforts. This is in the area of criticality. Yesterday I received their report, and I would like to submit that report to the committee for the record.

Senator **Exon**. Without objection, that is accepted and will be placed in an appropriate place after the remarks of the Secretary.

Mr. TUCK. Thank you, Senator Exon. The final report will be received within the next few weeks and it will address each item in the EG&G action plan for dealing with the plutonium in the ducts. All issues raised by either oversight body, the Ahearne Committee or the Defense Nuclear Facilities Safety Board, will be resolved satisfactorily or action plans prepared prior to any final decision regarding resumption of operations at Rocky Flats.

As you are aware, the Defense Nuclear Facilities Safety Board is independent, and, as such, the Department cannot dictate when or what reviews will be accomplished with regard to their action. We do expect, however, that the Advisory Committee will comment and provide their advice to Secretary Watkins on normalization of operations at Rocky Flats. Prior to resuming operations, the Department will conduct an on-site operational readiness review, as recommended by the Defense Nuclear Facilities Safety Board, after the contractor has established its readiness for the operation. We expect to announce this decision in the next several weeks.

With regard to future operations at Rocky Flats, I would like to expand on Secretary Watkins' comments at the May first hearing. Several options are under consideration in the modernization review of the nuclear weapons complex, which suggest close-out of operations at the Rocky Flats plant in the long-term. However, we must follow the decisionmaking process established in the National Environmental Policy Act (NEPA). The final determination will not be made until the record of decision from the programmatic environmental impact statement is made in fiscal year 1994. At this time, it is our preferred approach to phase out Rocky Flats operations in the long-term.

Finally, with all of the attention today on safety problems and problems on the uncertainties of the future, we must not lose focus on the importance of safety in nuclear weapons design and stockpile life of deployed weapons. This importance cannot be overstated. Nuclear weapons safety is a dual agency responsibility between the Departments of Energy and Defense, and it receives high priority attention. Our nuclear weapons safety actions address two principal hazards: first, the prevention of accidental nuclear yield; and second, prevention of accidental dispersal of radioactive material.

Our understanding of safety issues continues to evolve through reassessment and reexamination of accident scenarios and application of acceptable standards of safety. Safety is provided through a combination of operational restrictions and design features. There is a continuing safety review process to reevaluate earlier judgments about the safety status of operational systems. Each nuclear weapons system receives periodic, detailed, safety studies, and all issues are judged with respect to established safety standards. Nuclear safety rules for each system require Secretary of Defense approval in coordination with the Department of Energy.

Modern design features include improved electrical systems, insensitive high explosives, fire resistant features, and specialized detonators. New design features are being developed and used to further enhance nuclear weapon safety. New safety technology is introduced into the weapons stockpile through the development of new weapons systems, stockpile modernization, and modification of existing weapons stockpile improvement programs.

Both the Secretary of Energy and the Secretary of Defense work nuclear weapons safety issues through the Nuclear Weapons Council. They have formed a new, permanent Weapons Safety Committee, chaired by the Department of Energy, to specifically address joint nuclear weapons safety matters. The Weapons Safety Committee is involved in joint reviews of certain aspects of nuclear weapons safety. The results are reported, as appropriate, directly to the Nuclear Weapons Council and to the Secretaries of the Departments of Defense and Energy.

Secretary Watkins has taken other significant steps to improve the Energy Department's weapons safety process, thereby assuring that key matters are brought to upper management's attention in a timely manner. In addition, there is heightened sensitivity to safety throughout the Department.

One last point. This year we have worked very closely with the Office of Personnel Management and the Office of Management and Budget to develop legislation on a government-wide basis to establish a special salary structure for a limited number of very critical technical positions at the Department and to exempt a small, but specific, number of individuals from strictures on military and civilian retirement benefits of the dual compensation laws. The Office of Personnel Management has sent that improved and important legislation to Congress. In our view it must be passed so that we may attract highly qualified, technically competent, and talented individuals to serve us within the Department of Energy.

On the other hand, if prospects for passage during this session are considered poor by Congress, then I would ask, as Secretary Watkins asked on the first of May, that this committee consider extracting the two elements that I have just described that address critical positions and dual compensation waivers and move them in this session at a minimum in accordance with the procedures you deem appropriate. The individuals we are trying to attract are either military or civilian retirees with highly specialized skills. We continue to need these talents to help us solve the problems that we face in the weapons complex.

I want to thank you, Mr. Chairman, in particular, and others of this committee for your assistance and the assistance you provided last year in efforts to secure special provisions for critical technical positions. I think it was a catalyst for bringing the entire pay picture into focus and hopefully to fruition in this session, in this 101st Congress.

I hope, Mr. Chairman, that this further discussion has provided useful information to the Committee. As always, I stand ready to keep the Committee informed of our status and significant developments, and I would be pleased to answer any questions that you may have at this time.

Senator EXON. Thank you very much, Mr. Secretary. After you began your presentation, I was handed, along with other members of the committee, a more lengthy prepared statement. Do you wish to offer this for the record?

Mr. TUCK. Yes, please. Thank you, Senator.

Senator EXON. I would ask, then, without objection, that that be inserted into the record.

[The statement and supporting documents of Mr. Tuck follow:]

Statement of John C. Tuck
Under Secretary
Acting Assistant Secretary For Defense Programs
Department Of Energy
FY 1991 Authorization Hearings

INTRODUCTION

Mr. Chairman and Members of the Committee, I am John Tuck, Under Secretary of Energy and the Acting Assistant Secretary for Defense Programs. I am pleased to present the Department of Energy's (DOE) FY 1991 Defense Programs appropriation request for $7.5 billion. The request excludes funding for New Production Reactors, Environmental Restoration and Waste Management, Waste Transportation and Site Management, and the Naval Reactor program which are part of the National Security budget function but will be addressed by separate organizations within the Department.

I would like to thank the Senate Armed Services Committee for your continued support. Your recent approval of our FY 1990 reprogramming of $426 million will help us change the culture at DOE and set a course for the future. I will begin by offering some perspectives on the changing world scene, discuss the Defense Programs mission, address the challenges we are facing, and close with a discussion of Defense Programs budget needs.

THE CHANGING WORLD SCENE

Today, the world order is in a state of flux. Communism appears to be crumbling in Eastern Europe and democracy is on the rise. The Soviet Union, itself, is in the midst of significant political and economic change unthought of only one year ago. While it is premature to predict the outcome, we are hopeful these changes will be successful.

Recent trends in the Soviet Union have been dramatic in scope, and have permeated many facets of our relations with the Soviets. While all would agree that the threat from conventional forces is diminishing, the Soviet Union still has a formidable arsenal of strategic weapons. They continue, for example, to develop and deploy a growing number of new and improved missile delivery systems. Their production of nuclear materials continues unabated with no distinction between military and civilian production sources. To deal with this present imbalance will require that the U.S. maintain a credible nuclear deterrent for the foreseeable future. This lesson has been realized from 45 years of peace through strength, and we must not lose sight of it.

Credible nuclear deterrence, in today's environment, requires us to maintain the capability to respond to a variety of demands while negotiating with the Soviet Union for an orderly reduction in the numbers of strategic systems.

We have learned an important lesson in this country. Unfortunately, the lesson has been learned through years of neglect. For strategic defense to be successful, it must be achieved in a safe and environmentally acceptable manner. It makes little sense for this Nation to field a strong strategic deterrent if we spoil our environment, bring risk to our employees, and cause potential harm to our neighbors. This Nation cannot afford to meet production requirements at the expense of safety and the environment. There is no other choice; we must learn to achieve both.

While our nuclear weapons must be reliable, safety is absolutely essential. In this regard, DOE is actively pursuing the incorporation of state-of-the-art safety enhancements into new weapons systems. At the same time, we are continuing our nuclear weapons stockpile improvement program to enhance weapon safety for older weapons in the stockpile through retrofits and conversions.

MISSION

The Department of Energy's Defense Programs mission (Chart 1) contributes to national security by supporting the development, production, and maintenance of a credible, safe, and reliable nuclear deterrent. A variety of programs contributes to this mission beginning with the research, development, and testing capability. Defense Programs also oversees the manufacture, maintenance, and retirement of the weapons components and nuclear materials comprising our nuclear stockpile. Significant efforts are directed towards assuring that the Department's nuclear weapons, nuclear materials, facilities, and classified information are protected adequately. In addition, arms control efforts are being directed to assist other agencies in analyzing our adversaries' capabilities and their compliance with treaties.

CHALLENGES

Of late, this Nation's ability to produce nuclear materials in support of our defense responsibilities has been severely limited due almost entirely to environmental, safety and health concerns associated with operating old facilities. These concerns are the result of a long standing culture which placed the highest priority on production, with a lower priority being given to safe and environmentally sound operations. Management of the defense nuclear complex had not been brought into line with lessons learned in the civilian nuclear power industry subsequent to the Three Mile Island incident. The Department's defense production mission has been operating without a Senate confirmed Assistant Secretary for more than 2 years. Until recently, there were no long-range, comprehensive plans for cleanup of radioactive waste at DOE facilities. Facilities throughout the production complex had been allowed to deteriorate with no firm, integrated, and comprehensive plans for their modernization. Oversight of contractor activities had been inadequate, and in some cases conducted by personnel not possessing the requisite scientific, managerial, and technical skills to oversee these highly complex activities.

No one could review this list of challenges without concluding that there was an urgent need for change at the Department of Energy. On June 27, 1989, Secretary Watkins announced a Ten Point Plan to move the Department aggressively towards full accountability and compliance with environmental, safety, and health laws.

ACTIONS TAKEN TO DATE

We have initiated a major reorganization within Defense Programs to establish clear and direct lines of management responsibility. The Managers of the Savannah River Operations Office and the Rocky Flats Office now report to the Assistant Secretary for Defense Programs. Additionally, the Headquarters organizations have been realigned to provide added resources, clearer lines of authority, and enhanced capability to oversee field operations.

The recent increase in Federal pay, effective in January 1991, will provide some help in acquiring personnel with the technical skills required to manage the Department's national defense programs. Last year the Department supported Section 3142 of the Senate amendment to H.R. 2461, the FY 1990/1991 Defense Authorization Bill. The object of that provision was to enable scientists and other highly qualified individuals in the national laboratories to serve in critical positions in the Department of Energy without jeopardizing their return to the national laboratory system. While the full Congress did not support that provision, the Department continues to need such measures to recruit and retain appropriate personnel. Favorable action on these provisions likewise will provide the Department with the authorities it desperately needs in order to acquire the special skills and expertise necessary to enable it to resume safe and environmentally sound production activities in the Department's defense complex.

To put teeth into this new environmental, safety, and health emphasis, we restructured the existing system of award fee contracts for the defense production complex. Compliance with environmental, safety, and health laws and concerns now constitutes at least 51 percent of the contractors' semiannual award fee evaluation. This is a major departure from past practices where production took precedence over environmental concerns.

In addition, DOE: (1) established independent "tiger teams" to conduct environmental compliance assessments; (2) provided access to DOE nuclear facilities for State officials monitoring environmental, safety, and health compliance; (3) moved to strengthen technical capabilities of line-management and oversight personnel; (4) mandated compliance with OSHA standards in defense complex modernization plans; (5) improved DOE procedures for compliance with the National Environmental Policy Act; (6) established a new management team within the Department's office of Defense Programs to emphasize safety over production; (7) accelerated the cleanup of DOE facilities; (8) began development of a comprehensive epidemiological data repository containing information on past and present DOE workers that may be used by any qualified researchers; and (9) appointed an independent advisory panel to evaluate changes needed in the Department's epidemiological program.

DEFENSE ACTIVITIES

Effective and responsible management of the Department of Energy's Defense Programs demands that production requirements be placed into proper perspective. We must move aggressively towards full accountability and operating our facilities in compliance with environmental, safety, and health laws. The budget we have proposed reflects these changing priorities.

The Department's FY 1991 Defense Programs $7.5 billion budget request has been structured to: (Chart 2)

- Emphasize bringing our facilities into compliance with all Federal and State agreements and regulatory requirements.
- Continue operational improvements at Savannah River and Rocky Flats.
- Meet weapons production and nuclear material requirements as agreed to with the Department of Defense.
- Maintain an adequate weapons research, development, and testing capability.
- Support the transfer of technology to the private sector where appropriate.
- Improve management of Defense Programs operations through increased Federal staffing.
- Continue efforts to reduce the backlog of security reinvestigations.
- Close out the Special Isotope Separation program.

The $7.5 billion budget request (Chart 3) for the Department's Defense Programs in FY 1991 represents an 11 percent increase over the FY 1990 appropriation of $6.7 billion. Chart 3 compares the FY 1991 funding request to the FY 1990 appropriation for each program.

Consistent with the Department's changing priorities, Chart 4 presents the areas of major funding changes from FY 1990 to FY 1991. The area of largest increase, where a real growth of $338 million is being provided, is the continuation of reactor safety and support facility improvements at the Savannah River Site. The FY 1991 budget request also provides an additional $155 million for operational improvements at Rocky Flats. Of significant concern is the fact that in order to meet the high priorities of Savannah River and Rocky Flats, the Weapons Research, Development and Testing Program could not be supported at the desired level. This program element, which represents the base upon which our nuclear deterrent is founded, as well as much of our investment in the future, must be supported.

Weapons Activities

The Weapons Activities portion of Defense Programs is comprised of the Weapons Research, Development and Testing program, and the Weapons Production and Surveillance program. These programs are responsible for providing and maintaining this Nation with a modern, safe, and credible nuclear deterrent capability. The FY 1991 funding request for the Weapons Activities (Chart 5) totals $4.7 billion, a 9 percent increase over FY 1990.

Weapons Research, Development and Testing

For FY 1991, the overall Weapons Research, Development and Testing (RD&T) budget of $1.9 billion will remain at basically the FY 1990 funding level with no adjustment for inflation. The FY 1991 budget supports a technology transfer initiative ($10 million) to develop cooperative agreements between DOE's laboratories and U.S. industry. In this regard, we have already received over 40 high-quality proposals to carry out these types of arrangements. The FY 1991 budget also provides for a modest nuclear weapons test schedule. Let me emphasize that nuclear testing, within the core program, is necessary to support research to avoid technological surprise, conduct development programs for new weapons in response to changing threats, and to maintain the safety and reliability of our nuclear weapons stockpile. There continues to be a small reduction in our laboratory RD&T employment from 9,422 in FY 1990 down to 9,175 FTE's in FY 1991. These reductions will occur largely through attrition and transfer of staff to other laboratory programs.

The Nuclear Directed Energy Weapons (NDEW) program supports DOE's threat assessment mission and is necessary to avoid technological surprise. The NDEW budget has been scaled back from $214.4 million in FY 1990 to $191.9 million in FY 1991, and will focus on assessing three major concepts: x-ray laser, hypervelocity projectiles, and optical frequency laser concepts. This reduction is necessary in order to support other high-priority activities.

The budget request for the Inertial Fusion (IF) program is below the FY 1990 level of effort. However, the IF program is important and remains an integral part of the Weapons Research, Development and Testing technology base and helps our scientists understand the many phenomena that occur during a thermonuclear explosion. A near-term objective of the program is to explore the feasibility and affordability of a laboratory microfusion facility. This new experimental facility would advance weapons physics simulation and effects capabilities but cannot substitute for underground tests of nuclear weapons.

Weapons Production and Surveillance

The Weapons Production and Surveillance (WP&S) program supports the manufacture, monitoring, maintenance and retirement of all weapons comprising the Nation's nuclear weapons stockpile. This program funds the procurement of non-nuclear materials, the fabrication and assembly of new nuclear weapons and weapons components, and the life-time maintenance and reliability assessment of the existing nuclear weapons stockpile. Other activities include the development and operation of safe-secure systems for transporting nuclear weapons and weapons components; the construction of weapons system production and production support facilities; and environmental, safety, and health, and safeguards and security upgrades. This program is also responsible for plant operations at the seven weapons production plants. These requirements are developed jointly by the Departments of Defense and Energy and are approved by the President in the annual Nuclear Weapons Stockpile Memorandum.

The FY 1991 Weapons Production and Surveillance budget request is $2.8 billion--an increase of $382 million over FY 1990. After taking inflation into account, the budget request reflects increases of $155 million to pay for operational improvements at Rocky Flats, $19.7 million to enhance our transportation safeguards capability, $23 million to implement new training regimes--principally at Rocky Flats, and $23 million to partially fund the contract closeout with the Monsanto Corporation. The latter was part of the contractor changeover at the Mound Plant that occurred in 1988. Weapons production includes deliveries of the B61 Tactical Bomb, the W80-0 Sea Launched Cruise Missile Warhead, the W80-1 Air Launched Cruise Missile Warhead, the B83 Strategic Bomb and the W88 Trident II Warhead. Funding is also included to continue the Facilities Capability Assurance Program, an ongoing effort to upgrade aging weapons production facilities.

ROCKY FLATS RESUMPTION & BUILDING 371

I want to take a moment and address the situation at Rocky Flats. Plutonium operations were suspended in early December during the semi-annual nuclear materials inventory. We have extended the suspension of operations to permit EG&G, the new contractor, to install their own management team, gain a comprehensive understanding of plant operations, implement several changes in terms of formality and discipline of operations, and to increase the margin of safety in plutonium operations. On April 27, 1990, Admiral Watkins was briefed by EG&G on the status of normalization of operations at Rocky Flats.

They presented a schedule which will result in readiness for resumption of operations for the first two buildings in mid-June of this year, and the remaining buildings in July. The Department is currently reviewing this schedule; however, no approval has been granted. We recently held a public briefing in Colorado to outline actions contained in the schedule.

Admiral Watkins has directed the oversight boards be fully briefed on the EG&G plans including their evaluation and analysis of the accumulation over the past 30 years of plutonium in the ventilation system at Rocky Flats. Efforts continue to accurately assess the amount of plutonium accumulation although recent analyses indicate a very low risk of criticality. The results of EG&G analyses indicate less than half of the originally estimated amounts are probably contained in the ductwork. As EG&G further characterizes the material and refines their safety analysis, they are developing short- and long-term solutions to further improve facility safety. Their recommendations will be reviewed by DOE. In addition, Admiral Watkins directed that an independent review by Scientech be conducted of the EG&G recommendations. Their letter report was provided yesterday.

After we have had a chance to consider carefully the comments provided by the DOE field office and the oversight boards, Admiral Watkins expects to make an announcement on the status of resumption of operations within a few weeks.

The proposed Plutonium Recovery Modification Project, Building 371, will provide a reliable plutonium processing facility which is needed regardless of whether the Rocky Flats plant is relocated or not. This project will significantly reduce the radiation exposure to our workers, reduce waste generation, and help process backlogged plutonium bearing material. An environmental impact statement will be prepared for Building 371, and a safety analysis report will be completed before the facility is allowed to operate.

Nuclear Materials Production

The FY 1991 budget request for Nuclear Materials Production (NMP) (Chart 6) is $2.4 billion, a 15 percent increase over the FY 1990 appropriation of $2.1 billion. The major element driving the funding increase is the ongoing effort to improve our operations at the Savannah River Site, which I previously mentioned.

The NMP reactors are the Nation's only means of producing most nuclear materials to meet defense requirements. The principal materials produced are tritium and plutonium. Enriched uranium is obtained from gaseous diffusion. This program also produces nuclear materials for use in government research and development activities and in civilian research, commercial and medical applications. I cannot overemphasize that the facilities comprising this Nation's ability to produce nuclear materials are very old, fragile, and extremely vulnerable to disruptions.

Most of the facilities in the Defense Programs' complex were built during the

1950's and early 1960's largely as a reaction to World War II and the following Cold War. As a result, the facilities were built to much less stringent environmental and safety regulations. During the 1970's and 1980's, a number of these facilities were permanently shut down after years of neglect. Meanwhile, the commercial nuclear industry was learning much about the potential effects of its operations on workers and the public. They responded by making physical and procedural changes in the way they operated their facilities. DOE now faces similar challenges but, at the same time, must plan and implement the modernization of the complex for the future.

Facilities and Operational Improvements

Currently, the Nuclear Materials Production program is not producing any tritium or plutonium. The Savannah River reactors have been in extended outage since August of 1988 to provide needed improvements to reactor hardware, procedures, training, management systems and practices, and maintenance, with special emphasis on improving human performance throughout the system. Many of these improvements are not one-time activities, but rather will require a sustained level of funding for as long as the reactors operate. The need to continue to operate facilities that were designed and built over 35 years ago has led to a backlog of maintenance upgrades and operational improvements that need to be addressed.

The program's first priority is to resume production of tritium as soon as improvements can be made to ensure the continued safe and reliable operation of the reactors at Savannah River. Corrective actions are well underway and Admiral Watkins announced on May 1, 1990, that the K Reactor is currently scheduled to be restarted for low power testing in December 1990. Following this low power testing to verify proper operation, power operations could begin in late December 1990 or early January 1991. Modifications and improvements for the safe restart of the P Reactor are expected to be completed in March 1991 with power operation in April 1991. The L Reactor will be the third reactor to be ready for restart, and it will not be ready for restart until September 1991.

We feel that these schedules are achievable and note that the restart dates are predicated on completion of the NEPA decisionmaking process through resolution of the public comments on the reactor operation environmental impact statement. The draft environmental impact statement was released for comment on May 4, 1990. Additional schedule uncertainties are associated with litigative challenges to reactor operation, new issues raised by the oversight groups reviewing the restart process, and resolution of new technical problems that may emerge.

The current status of many of the nuclear material processing operations at Savannah River is similar to that of the reactors, before intensive safety enhancement efforts began. Funding priorities in prior years forced the deferral of preventive maintenance, operational improvements, operator training, enhanced technical support, and improved incident analysis systems. DOE cannot, and will not, operate these facilities without the assurance that they can be operated safely and reliably. The Department must begin to correct these deficiencies or face eventual facility shutdown.

On December 21, 1989, the National Research Council of the National Academy of Sciences issued a report entitled, "The Nuclear Weapons Complex, Management for Health, Safety and Environment." The Council's study focused on the 17 major non-reactor installations in the nuclear weapons complex. Their report provided recommendations for many improvements in the areas of management, industrial safety, fire safety, criticality safety, seismic safety, and occupational health. Many of their findings echo the type of improvements currently included in our reactor restart program. The Department is preparing a response to the report and will develop an implementation plan to address these issues. However, the results of the Council's study were not unexpected. In fact, based on experience gained at our reactor facilities, DOE had already taken steps to identify problems at non-reactor facilities. At the Savannah River Site, this resulted in the development of a Non-Reactor Improvements Plan. Although funded at a slower pace than the Reactor Operations Management Plan, the Non-Reactor Improvements Plan and similar efforts at other sites have been incorporated into our FY 1991 budget request.

NMP Initiatives

These initiatives include improvements in procedures and training at the Savannah River Site, with emphasis on the reactor operations area and reactor safety construction activities. Efforts will continue on the complex-wide productivity retention facility enhancements, restoration of the Idaho Fuels Processing Facility to provide increased capacity for the increased recovery of Naval spent fuels, and ongoing capital equipment expenditures for facility and infrastructure improvements.

This budget implements an orderly closeout of the Special Isotope Separation (SIS) program. Based on a careful review of weapons-grade plutonium requirements, we have determined that the production capability that would have been provided by the SIS facility cannot be justified in relation to higher funding priorities. We will, however, complete development activities during FY 1991 in order to preserve a viable option to deploy this technology, should future national security demands dictate.

Security Affairs

The Security Affairs portion of Defense Programs is comprised (Chart 7) of the Verification and Control Technology program, the Nuclear Safeguards and Security program, and the Security Investigations program. The FY 1991 budget request for these programs totals $330 million; a 13 percent increase over the FY 1990 appropriation of $292 million.

Verification and Control Technology

The Verification and Control Technology program supports the development and execution of U.S. national security and foreign policy interests in the areas of treaty verification, intelligence, and arms control. The $174 million request provides an increase of $8.2 million for the FY 1991 effort. We have developed, or are developing, systems to verify compliance with the Limited Test Ban Treaty, Threshold Test Ban Treaty, Peaceful Nuclear Explosions Treaty, and Intermediate Range Nuclear Forces Treaty, as well as a future Strategic Arms Reduction Treaty, Chemical Warfare Treaty, Conventional Forces in Europe Treaty, and the Open Skies initiative.

In addition to longstanding intelligence interests and activities, Secretary Watkins has expanded the role of intelligence to provide foreign intelligence in support of such Departmental and national policies as the development of a comprehensive National Energy Strategy, safe and environmentally sound disposal of radioactive waste, strengthening the domestic energy industry's ability to compete in the international marketplace, and responding to the challenge of potential global climate change. Effective last month, the Office of Intelligence, under Mr. Bob Daniel, now reports directly to the Secretary.

Nuclear Safeguards and Security

The Nuclear Safeguards and Security program is responsible for developing policy and research and development into measures to assure adequate protection of the Department's nuclear weapons, nuclear materials, facilities and classified information against theft and sabotage, espionage and terrorist activity. Technical support is also provided to international activities designed to minimize the proliferation of nuclear weapons. The FY 1991 request of $91 million will provide a balanced program, with emphasis on strengthening protection against the potential insider threat. This is in keeping with recommendations contained in an interim report prepared by the Secretary's Safeguards and Security Task Force which is reviewing the status of safeguards and security throughout the DOE complex.

Security Investigations

The Security Investigations program funds background investigations for DOE and contractor personnel who require security clearances. Such clearances are required for those individuals requiring access to restricted data, national security information or special nuclear material. Actual investigations are conducted by the Federal Bureau of Investigation and the Office of Personnel Management.

The FY 1991 budget request of $65 million will enable the Department to continue to conduct initial investigations for new employees while reducing significantly the backlog of overdue reinvestigations. Additional security investigation requirements result from increased remedial efforts underway currently at the Savannah River Site and Rocky Flats Plant, as well as implementation of the Personnel Security Assurance Program for those personnel involved with nuclear explosives, components and special weapons assemblies.

CLOSING REMARKS

We have worked extremely hard this year to obtain a firm understanding of the magnitude of the problems facing DOE. During this period we have established new goals, initiated a major change in the DOE culture, and developed new budget plans to achieve our objectives. Along the way, I believe we have set in motion those processes necessary to carry the Department to a new, higher level of efficiency and effectiveness. At present, we are by no means out of the tunnel but at least we are beginning to see a distant glimmer of light. I expect the Department's condition to be good by the end of this year, and excellent by the end of 1991.

While we are making progress, we have concerns (Chart 8) and there are risks associated with accomplishing our objectives on schedule. While we believe the Savannah River reactor restart schedule will be achieved, there are concerns associated with the timely resumption of operations at Rocky Flats, and our ability to meet future DOD weapon delivery requirements. Other uncertainties, for which funding has not been included in our FY 1991 budget request, are the unknown requirements which may be identified by our Tiger Team investigations, and verification requirements which are not in place today. We are also concerned about the downward trend we are experiencing in our national laboratories. In the present time of major change, the Weapons Research, Development and Testing Program represents our ability to respond and the fundamental capabilities which must be supported.

I personally want to thank you for your support. It has been a significant factor in helping us change the course at the Department of Energy. As new dimensions take shape--sounder environmental stewardship, safer facility operations, and changing defense requirements--I look forward to working with the Congress to secure the necessary resources and support to carry out effectively and completely the Department's important mission.

DEFENSE PROGRAMS

CHART 1

DEFENSE PROGRAMS MISSION

- SUPPORT NATIONAL SECURITY POLICIES OF THE UNITED STATES FOR A NUCLEAR DETERRENT
    - CONDUCT ALL OPERATIONS IN A SAFE, SECURE AND ENVIRONMENTALLY RESPONSIBLE MANNER
    - CONDUCT RESEARCH AND EXPERIMENTS ON THE MILITARY APPLICATION OF ATOMIC ENERGY
    - PRODUCE AND MAINTAIN NUCLEAR WEAPONS AND NUCLEAR MATERIALS, AND MANAGE GENERATED WASTE
    - ASSESS FOREIGN NUCLEAR WEAPONS CAPABILITIES AND COMPLIANCE WITH TREATIES
    - PROVIDE SAFEGUARDS AND SECURITY FOR NUCLEAR WEAPONS, DEVICES, MATERIALS, FACILITIES, AND INFORMATION

CHART 2

FY 1991 DEFENSE PROGRAMS BUDGET

- EMPHASIZES ACTIVITIES TO BRING DP FACILITIES INTO COMPLIANCE WITH APPLICABLE REGULATIONS
- SUPPORTS INTENSIVE EFFORTS TO IMPROVE OPERATIONS AT SAVANNAH RIVER AND ROCKY FLATS
- PROVIDES DELIVERY OF NEW WEAPONS AND STOCKPILE IMPROVEMENTS TO EXISTING WEAPONS TO THE DEPARTMENT OF DEFENSE
- MAINTAINS ADEQUATE RD&T BASE
- SUPPORTS TECHNOLOGY TRANSFER TO PRIVATE SECTOR
- PROVIDES INCREASE FEDERAL STAFFING TO IMPROVE MANAGEMENT OF DP OPERATIONS
- SUPPORTS GOAL FOR ELIMINATING SECURITY INVESTIGATIONS BACKLOG BY 1993
- CLOSES OUT SPECIAL ISOTOPE SEPARATION PROGRAM

6A

DEFENSE PROGRAMS

CHART 3

DEFENSE PROGRAMS
FY 1991 REQUEST
(DOLLARS IN MILLIONS)

	FY 1989 APPROP.	FY 1990 APPROP.	FY 1991 REQUEST
RESEARCH, DEV. AND TESTING	$1,839	$1,864	$1,885
PRODUCTION AND SURVEILLANCE	2,104	2,375	2,757
PROGRAM DIRECTION	83	99	106
NUCLEAR MATERIALS PRODUCTION	1,943	2,092*	2,413
VERIFICATION AND CONTROL TECH.	155	166	174
SAFEGUARDS AND SECURITY	79	85	91
SECURITY INVESTIGATIONS	43	41	65
SUBTOTAL DEFENSE PROGRAMS	$6,246	$6,722	$7,491
(% CHANGE)			(+11.4%)

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* INCLUDES $135 MILLION FROM DOD

CHART 4

DEFENSE PROGRAMS
SUMMARY OF CHANGES FROM FY 1990
(DOLLARS IN MILLIONS)

FY 1990 CONGRESSIONAL APPROPRIATIONS	$6,722
ESCALATION	+ 280
SAVANNAH RIVER OPERATIONS	+ 338
ROCKY FLATS INITIATIVE	+ 155
INCREASED SECURITY INVESTIGATIONS	+ 23
WEAPONS TRANSPORTATION SAFEGUARDS INITIATIVE	+ 20
INCREASED FEDERAL STAFFING	+ 14
MONSANTO PARTIAL CONTRACT SETTLEMENT	+ 23
WEAPONS RD&T	- 63
SIS CLOSEOUT	- 56
BASE PROGRAM (MAINTENANCE/SAFETY & HEALTH/ETC)	+ 35
FY 1991 CONGRESSIONAL REQUEST	$7,491

65

DEFENSE PROGRAMS

CHART 5

FY 1991 BUDGET REQUEST
WEAPONS ACTIVITIES
(DOLLARS IN MILLIONS)

	FY 1989 APPROP.	FY 1990 APPROP.	FY 1991 REQUEST
RESEARCH, DEVELOPMENT & TESTING			
CORE PROGRAM	$1,435.6	$1,480.2	$1,525.9
NUCLEAR DIR. ENERGY WEAPONS	240.3	214.4	191.9
INERTIAL FUSION	163.5	169.2	166.8
TOTAL RD&T	$1,839.4	$1,863.8	$1,884.6
PRODUCTION & SURVEILLANCE	$2,103.9	$2,374.5	$2,757.0
PROGRAM DIRECTION	$ 83.2	$ 99.4	$ 106.4
TOTAL WEAPONS	$4,026.5	$4,337.4	$4,748.0
(% CHANGE)			(+9.5%)

CHART 6

FY 1991 BUDGET REQUEST
NUCLEAR MATERIALS PRODUCTION
(DOLLARS IN MILLIONS)

	FY 1989 APPROP.	FY 1990 APPROP.	FY 1991 REQUEST
BASE PROGRAM:			
SAVANNAH RIVER	$1,040	$1,194	$1,578
OTHER	632	613	591
SPECIAL ISOTOPE SEPARATION	102	119	67
NAVAL REACTOR SUPPORT	169	166	177
TOTAL REQUEST	$1,943	$2,092	$2,413
(% CHANGE)			(+15.3%)

DEFENSE PROGRAMS

CHART 7

FY 1991 BUDGET REQUEST
SECURITY AFFAIRS
(DOLLARS IN MILLIONS)

	FY 1989 APPROP.	FY 1990 APPROP.	FY 1991 REQUEST
VERIFICATION AND CONTROL TECH.	$ 155	$ 166	$ 174
SAFEGUARDS AND SECURITY	79	85	91
SECURITY INVESTIGATIONS	43	41	65
TOTAL SECURITY AFFAIRS	$ 277	$ 292	$ 330
(% CHANGE)			(+13.0 %)

CHART 8

FY 1990/1991 CONCERNS

- TIMELY RESTART OF SAVANNAH RIVER
- RESUMPTION OF OPERATIONS AT ROCKY FLATS
- ABILITY TO MEET DOD REQUIREMENTS
- NEW REQUIREMENTS FROM TIGER TEAM INVESTIGATIONS
- FUNDING FOR FUTURE VERIFICATION REQUIREMENTS
- DOWNWARD TREND IN RESEARCH, DEVELOPMENT AND TESTING

STATEMENT SUBMITTED BY THE
U.S. DEPARTMENT OF ENERGY

This statement summarizes the Department's fiscal year 1991 budget request for Environmental Restoration and Waste Management activities funded from the "053--Atomic Energy Defense Activities" budget account.

INTRODUCTION

The Department of Energy (DOE) faces the largest environmental cleanup problem among the Federal agencies. Mainly through its defense production activities, DOE has introduced quantities of radioactive and hazardous chemical pollutants into the soil and surface water. These problems resulted from 40 years of emphasis on production, far too often at the expense of the environment. To put things right, Secretary Watkins initiated a new operating philosophy at DOE and formulated a 10-point plan to better manage the Department's responsibilities in the areas of environmental protection, public health, worker safety, and waste management.

Secretary Watkins' principal guideline is that there must be compatibility between our DOE mission to produce defense materials and the protection of health and the environment. DOE can only be considered successful if we provide the materials necessary for the defense of the Nation without insult to the environment or injury to public and worker health and safety.

ENVIRONMENTAL RESTORATION AND WASTE MANAGEMENT FIVE-YEAR PLAN

In March 1989, Secretary Watkins directed the Department to prepare an *Environmental Restoration and Waste Management Five-Year Plan* as a means of gaining a better understanding of the specific cleanup and compliance criteria required in the near term, as well as the cost of those actions. The initial Five-Year Plan was issued in August 1989 and is the cornerstone of the Department's short and long-term strategies to consolidate and coordinate DOE's cleanup activities. The Five-Year Plan consolidates cleanup activities in the areas of Defense Programs, Nuclear Energy, and Energy Research; treats them as a unified program; and establishes an agenda for compliance and cleanup against which progress can be measured.

The Five-Year Plan identifies three specific compliance-related activities. *Corrective Activities* denotes activities necessary to bring facilities into compliance with applicable Federal, State, and local environmental requirements. *Environmental Restoration* includes the assessment and cleanup of surplus facilities and inactive sites. *Waste Management Operations* involves the treatment, storage and disposal of wastes generated as a result of ongoing operations at active facilities. *Technology Development* of new and improved technologies for waste minimization and cleanup is carried out to support the goals of each of these three areas. The proposed FY 1991 budget closely follows the structure of the Five-Year Plan.

The work in the Five-Year Plan is divided into the following priorities which help to establish the relative order of funding requirements. *Priority 1* activities are necessary to prevent near-term adverse impacts to workers, the public, or the environment. *Priority 2* activities are necessary to comply with existing compliance agreements, in place or in negotiation, between DOE and Federal, State, and local agencies. *Priority 3* activities are required to comply with external environmental regulations that were not identified in priority categories 1 or 2. In addition, Priority 3 provides for compliance with DOE Orders that implement external regulations or set specific DOE regulatory standards. *Priority 4* activities are not required by regulation, but would be desirable to do and initiatives to meet anticipated future requirements.

Secretary Watkins established a new line organization within DOE Headquarters last November to implement his Five-Year Plan -- the Office of Environmental

Restoration and Waste Management -- and appointed Leo P. Duffy to serve as its first Director.

PUBLIC REVIEW OF THE FIVE-YEAR PLAN

Secretary Watkins encouraged constructive input into how the plan is developed. DOE invited representatives chosen by the Governors of Colorado, Idaho, Kentucky, Nevada, New Mexico, Ohio, Oregon, South Carolina, Tennessee, and Washington to review the Environmental Restoration and Waste Management Five-Year Plan while it was being developed. In addition, the Five-Year Plan was reviewed by elected leaders of the Yakima Indian Nation from Washington State and the Shoshone-Bannock Tribe from Idaho, representatives from the National Conference of State Legislatures, the National Governors' Association, and the National Association of Attorneys General. The Plan was reviewed for its technical content and approach by the National Academy of Sciences' (NAS) Board on Radioactive Waste Management. DOE also sought Environmental Protection Agency (EPA) and Office of Management and Budget (OMB) views and has addressed the concerns expressed by these external reviewers.

The first annual update of the Five-Year Plan for fiscal years 1991 through 1996 is well underway. The updated Plan's structure follows the presentation of the initial Plan, but adds new sections on Technology Development to direct scientific and engineering resources, to address environmental compliance needs and to outline Transportation Management requirements.

DOE improved the Plan's external review process by adding six States and one Indian Nation to the review group, as well as representatives from labor unions, industry associations, public interest groups, and environmental groups. DOE officials will exhibit its revised Five-Year Plan this summer at conferences sponsored by the National Conference of State Legislatures, the League of Women Voters, the American Medical Association, the National Association of Counties, the National League of Cities, and the National Association of Regulatory Commissioners.

SINGLE APPROPRIATION ACCOUNT

To formalize the commitment of Congress and the Administration to fund cleanup work adequately, the FY 1991 budget request proposes to establish a separate appropriation account to fund DOE cleanup, compliance, waste management, and related technology development initiatives previously funded by the DOE Offices of Defense Programs, Nuclear Energy, and Energy Research. Uranium Supply and Enrichment Activities remain in a separate appropriations account due to the unique nature of the "net-zero appropriation" for management of this country's uranium enrichment enterprise.

We believe that a unified budget presentation should help to avoid funding trade-offs between environmental protection projects and production or other programmatic activities. Establishing a single appropriations account is not intended to change or lessen Congressional oversight of Five-Year Plan activities. A separate appropriations account helps ensure that funds meant for cleanup and environmental restoration will be spent according to the priorities established among competing cleanup projects and not relegated to only what remains after DOE production and program needs have been satisfied.

The FY 1991 budget presents, for the first time, a single, focused, and unified program which directly relates to the Five-Year Plan. To assist this Committee's oversight and authorization of proposed Five-Year Plan activities, we have segmented defense-related activities from Environmental Restoration and Waste Management budget totals.

BUDGET OVERVIEW

The budget provides approximately $19 billion over five fiscal years (FY 1991 through FY 1995) for completing the highest priority activities of the Five-Year Plan (in addition to $0.8 billion for uranium enrichment cleanup). The budget request for FY 1991 will fund activities necessary to prevent near-term adverse health and environmental impacts and to ensure that existing compliance or cleanup agreements are maintained. The budget request also provides some additional funds for other important projects to reduce risk, promote compliance, reduce costs, and prevent disruption of DOE missions. The President's budget request completely funds Five-Year Plan Priorities 1 and 2 and funds most of Priority 3 activities. The FY 1991 budget request of $2,791 million is $573 million, or 26 percent, above the FY 1990 level. This budget continues the rapid acceleration of the cleanup of DOE facilities started by President Bush's allocation of an additional $300 million to the FY 1990 budget request and congressional action to appropriate an additional $357 million for FY 1990. The work described in the FY 1991 budget would require $2,933 million; however, the Department recognizes that project slippages estimated at $142 million are likely, given the large number of individual projects (over 1,500) and the probable delays in attracting and acquiring the required technical and administrative staff at DOE and in the States to administer this large, complex program. DOE, its contractors, and DOE's regulators are all competing for a very limited talent base which will affect project schedules during the FY 1990-91 timeframe.

The following table summarizes the five major program elements identified in the FY 1991 budget request.

ENVIRONMENTAL RESTORATION AND WASTE MANAGEMENT
FUNDING SUMMARY

($ in Millions)

	FY 1990 APPROPRIATIONS		FY 1991 REQUEST	
	Total	Defense Related	Total	Defense Related
Corrective Activities	124.7	107.7	168.6	141.5
Waste Management	$1,247.7	$1,125.6	$1,652.3	$1,516.7
Environmental Restoration	656.8	506.5	882.4	633.2
Technology Development	183.5	183.3	206.0	200.3
Program Direction	5.5	-	24.1	-
TOTALS	$2,218.3	$1,923.1	$2,933.4	$2,491.7
Less Adjustment for Slippages			-142.0	
ADJUSTED TOTAL			$2,791.4	

Corrective Activities represent the smallest component of the costs ($168.6 million). Most of these funding requirements are in the near-term (fiscal years 1990 through 1996), reflecting the need for prompt action to bring operational facilities into compliance with existing standards.

Waste Management activities comprise the largest portion of the estimate ($1,652.3 million) or 56 percent of the total FY 1991 request. This reflects the costs of constructing and operating waste management facilities. *Environmental Restoration* funding of $882.4 million is more than double the FY 1989 level. This reflects the gradual transition from the investigation and feasibility studies under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Resource Conservation and Recovery Act (RCRA) to actual remediation projects. Since the ultimate scope and complexity of the restoration projects has not yet been determined, this activity has the greatest degree of cost uncertainty.

Technology Development is essential to the overall cleanup and waste management program by the development of innovative permanent disposal solutions and lower costs. The objective of this activity is to accelerate the conception, creation, development, and deployment of the next generation of environmental cleanup and waste management. A separate research and development (R&D) plan was issued last November to describe the current state of cleanup and waste minimization technologies and establishes milestones for research. The FY 1991 request of $206 million represents approximately 7 percent of the total budget request. DOE plans to allocate 10 percent of its Environmental Restoration and Waste Management resources for Technology Development in the outyears but recognizes that some time is needed to build the infrastructure necessary to conduct the R&D initiatives. We are engaged presently in a comprehensive internal and external peer review of the technology development program needs and priorities. This examination has delayed decisions on the target funding allocations for DOE field offices but this added review time should place the program on a sounder and better planned basis for the future.

The requested *Program Direction* funding of $24.1 million for FY 1991 would provide for the Headquarters staff responsible for developing policy, administration, budget formulation and execution, long-range planning, monitoring and evaluation of contractor performance, and providing the linkage between the Department and other agencies, Congress, public interest groups, and the private sector. The FY 1991 request also provides funding for field office staff associated with conducting environmental management activities in certain DOE Operations Offices.

A detailed description of proposed program activities funded under the FY 1991 budget request follows.

CORRECTIVE ACTIVITIES

The Corrective Activities Program is aimed at identifying what costs and activities are required to bring our facilities into full compliance with existing regulatory requirements. The goal of the Corrective Activities Program is to bring active and standby facilities at all DOE sites into compliance with all applicable air, water, and solid waste regulatory requirements, and DOE orders. The primary regulations governing these activities are the Clean Air Act, Clean Water Act, Resource Conservation and Recovery Act (RCRA), Safe Drinking Water Act, Toxic Substances Control Act, and State and local ordinances. This program is composed of corrective activities at facilities operated by four major DOE program: Environmental Restoration and Waste Management, Defense Programs, Nuclear Energy, and Energy Research. Although accounted for under this consolidated budget activity, the corrective activities themselves will be managed by the respective base program, and the FY 1990 and FY 1991 budget requests do not reflect the establishment of an Enviornmental Restoration and Waste Management subactivity. The FY 1991 budget request for Corrective Activities is tabulated below.

CORRECTIVE ACTIVITIES
FUNDING SUMMARY

($ in Thousands)

Subactivity	FY 1990	FY 1991
Defense Programs	$107,736	$141,537
Nuclear Energy	995	4,112
Energy Research	16,023	22,949
TOTAL	$124,754	$168,598

Thus, the FY 1991 budget request for Corrective Activities of $168,598,000 is distributed among three base programs. Within the Defense Programs subactivity, the increase provides for environmental monitoring and analytical laboratory upgrades required to meet RCRA guidelines, milestones established by the Hanford Federal Facility Agreement and Consent Order (commonly referred to as the Hanford Tri-Party Agreement), support for environment, safety, and health (ES&H) improvements at DOE national laboratories, replacement of PCB-contaminated transformers at Los Alamos National Laboratory (LANL), construction of flood walls around storage areas at the Kansas City Plant, and completion of a potable water system at the Nevada Test Site (NTS). The increase for the Energy Research corrective activities program is for conducting risk assessments at Lawrence Berkeley Laboratory (LBL) and for installation of low-level waste lines at the Oak Ridge National Laboratory (ORNL). The Nuclear Energy program increase is primarily for construction project activities at various facilities, such as the Energy Technology Engineering Center (ETEC) in California, to provide for design, procurement, and installation of modifications needed to bring liquid effluent into compliance.

SAVANNAH RIVER COOLING TOWERS

Recently developed information indicates that the Savannah River Cooling Tower Project (89-D-142) will not be as costly as previously estimated. Accordingly, the FY 1991 request of $44,600,000 will be reduced to $28,000,000. Approximately $21,000,000 of the amount appropriated for FY 1990 will not be required in this year, and a reprogramming request is being prepared for DOE to use those funds to meet other pressing compliance activities. Those funds not required in FY 1991 will be considered a part of the $142 million reduction for slippages in the overall Environmental Restoration and Waste Management program.

WASTE MANAGEMENT OPERATIONS

The goal of the Waste Management Operations program is to assure the safe and effective treatment, storage, and disposal of radioactive, hazardous, mixed, and sanitary wastes that result from the Department's nuclear activities. There is a firm mandate to implement an aggressive program to minimize the amount of waste generated by DOE activities in the future. As for all of our programs, these activities are to be carried out in full compliance with all applicable Federal, state, and local requirements. A funding summary for Waste Management Operations follows.

WASTE MANAGEMENT OPERATIONS
FUNDING SUMMARY

($ in Thousands)

	FY 1990 APPROPRIATIONS		FY 1991 REQUEST	
OPERATING EXPENSES:	Total	Defense Related	Total	Defense Related
Continuity of Operations	$ 264,368	$ 255,905	$ 283,445	$ 271,985
Waste Isolation Pilot Plant	79,060	79,060	112,237	112,237
Defense Waste Processing Facility	124,097	124,097	128,763	128,763
Hanford Waste Vitrification Plant	16,056	16,056	25,000	25,000
Treatment, Storage, Disposal	359,695	347,362	518,021	503,442
West Valley Demo Proj	87,360	-	90,000	-
Waste Minimization, Low-Level Waste, Program Support, Other	89,455	83,792	108,434	96,500
Construction and Capital Equipment	$ 227,612	$ 219,349	$ 386,595	$ 378,772
TOTAL	$1,247,703	$1,125,621	$1,652,312	$1,516,699

The FY 1991 request for the Waste Management Operations program is $1,652,312,000, an increase of $404,609,000 over FY 1990 appropriations. This 32 percent increase reflects an increase of $298,719,000 for activities required to support activities necessary to comply with RCRA-based hazardous waste management regulations, while meeting required milestones established by formal agreements with the regulator, and to upgrade the conduct of our extensive operations. It also includes an increase of $71,890,000 for initiating construction of the Hanford Waste Vitrification Plant (HWVP), upgrading an Idaho tank farm, the start of design of a transuranic (TRU) and low-level waste treatment facility at Hanford, and the start of other construction projects. Finally, there is an increase of $34,000,000 for the Plutonium-Uranium Extraction (PUREX) Plant at Hanford in support of waste management activities beginning in the fourth quarter of FY 1991.

DOE treats and disposes of radioactive waste on DOE-owned property to reduce the likelihood of human and environmental exposure and to reduce potential future liability. Commercial facilities can be considered for treatment of certain wastes. Radioactive mixed waste is managed to meet both RCRA treatment standards for the hazardous components and DOE's performance objectives for the radioactive constituents. DOE Order 5820.2A establishes specific requirements to properly transport, handle, and dispose of the radioactive component of the waste streams. This Order, issued in September 1988, is directing significant efforts toward adequate waste characterization and waste form testing to determine the adequacy of present and planned treatment, and DOE will design future radioactive waste disposal sites to meet prescriptive objectives stated in the Order.

One area that demands intense effort is the proper management of radioactive mixed wastes (wastes containing both a hazardous and radioactive component). Through the amendment to the RCRA in 1984 and DOE's interpretive byproduct rule, radioactive mixed waste is now subject to regulation under both RCRA and the Atomic Energy Act of 1954 (AEA), as amended. Requirements for managing certain radioactive mixed wastes were enacted before the Department had facilities available to handle the waste. DOE's concern that the continued operation of essential defense nuclear materials and weapons production plants may be construed to violate RCRA regulations (in particular, the Land Disposal Restricted (LDR) waste storage prohibitions in 40 CFR 268.50) has been communicated to EPA. There is a lack of available treatment capacity for the LDR streams, and these streams must remain in controlled storage until the wastes can be thoroughly categorized, until permits can be obtained to operate, and until treatment capacity can be built. DOE has voluntarily disclosed this condition to EPA and is establishing agreements with the regulators to enable the Department to continue its defense mission and waste management operations while coming into compliance with all applicable EPA and State regulations.

DOE provided EPA a comprehensive description of all radioactive mixed wastes that are now subject to LDR under RCRA by submitting the "National Report on Prohibited Waste and Treatment Options" on January 17, 1990. This report provided specific information that indicated over 30 sites generate or store 221 radioactive mixed waste streams that contain prohibited wastes. Many of these wastes were generated from the production of nuclear materials for defense or research purposes, others from recycling or reprocessing of spent materials. With severely limited capacity to treat these wastes, DOE foresees the need to negotiate specific compliance agreements with the EPA and our host States as we implement the new requirements. Prior to this report, we provided EPA a table of all radioactive mixed wastes and indicated the lack of available treatment facilities to treat these wastes in order to justify a 2-year extension in setting treatment standards. As the EPA promulgates additional rules, DOE will likely be constrained at times by the Federal budget process timetable and may not be able to respond rapidly. Active participation with the regulators assists in educating all parties to institutional and technical constraints.

WASTE ISOLATION PILOT PLANT (WIPP)

A year ago, the Department had anticipated that the WIPP would be ready to receive waste later that same year. In June 1989, the Secretary announced that the facility would not be ready to open as planned. The Secretary called for the development of a new baseline and also established an independent Blue Ribbon Panel (BRP) to review certain WIPP-related issues.

In October, the Department completed a draft Decision Plan on WIPP which identified the activities that need to be completed satisfactorily prior to WIPP receiving waste, the process for conducting these activities, and an estimate of the time required for their completion. DOE solicited comments on its WIPP Decision Plan from the Governors and congressional delegations of Colorado, Idaho, New Mexico, Nevada, South Carolina, Tennessee, and Washington, as well as from the New Mexico Environmental Evaluation Group (EEG), EPA, the Departments of Defense and Interior, OMB, the Secretary's independent Advisory Committee on Nuclear Facility Safety (ACNFS), and other parties. The Secretary will not set a date for opening the WIPP facility until he is confident that a series of preoperational activities -- many of which are outside of the Department's control -- can be completed successfully. Significant progress has been made in completing many of the prerequisites.

For example, construction of the facility was completed in 1989. In August 1989, the Nuclear Regulatory Commission (NRC) granted its Certificate of Compliance for the TRUPACT-II shipping container. These containers are being manufactured and the related equipment is being procured. We are also pursuing cooperative efforts with States to assure safe transportation of TRU waste to the WIPP site. The "Final Plan for the WIPP Test Phase: Performance Assessment" was issued in April 1990. Comments were received from the NAS, EPA, BRP, and the EEG. There is general consensus that tests with representative waste in limited amounts should begin without delay. The engineering design of the bin tests is underway with fabrication of the bins to be completed this summer. The development of procedures, as well as the capability to characterize the waste to be used in the test phase, is also underway. A draft of the Waste Characterization Plan was issued in May 1990 for external review. In addition, following external review by EPA, EEG, and BRP, the final Retrieval Plan for the WIPP Test Phase was issued in May 1990. In January, over 2,000 copies of the WIPP Supplemental Environmental Impact Statement (SEIS) were distributed to members of Congress, State and Federal Agencies, and concerned individuals. Shortly, the Secretary will issue the Record of Decision (ROD) resulting from the analysis of alternatives that were considered. The ROD will also address the recommended option for the operations demonstration.

In the areas of facility operational safety, the WIPP project has made significant progress in the last year. Reviews of the Final Safety Analysis Report (FSAR) by DOE's Office of Environment, Safety, and Health culminated in the issuance of a Safety Evaluation Report (SER). This SER independently documents the completeness and adequacy of the FSAR in accordance with DOE directives. In addition, reviews have been conducted by the ACNFS, the EEG, and the New Mexico State Environmental Improvement Division. Each of these reviews adds another level of assurance that the WIPP facility's FSAR represents a systematic analysis of the potential hazards associated with operating the facility and that reasonable measures have been taken to eliminate, control, or mitigate the hazards. Completion of this review process is expected this summer.

Another closely related effort is the preoperational readiness reviews. During the last year, these reviews have been conducted by a number of internal as well as external groups to provide independent assessments of the readiness of the WIPP to be operated in a safe manner. The reviews are continuing and are expected to be completed during 1990 in support of initial waste receipt. These reviews will be followed by an integrated systems check out for the bin and alcove test program to assure the facility is ready for receipt of each type of test waste.

Another activity has been the preparation and submittal of a No-Migration Variance Petition to EPA in accordance with RCRA provisions. The current land withdrawal issued by the Interior Department for the WIPP project expires in June 1991. This land withdrawal does not authorize the transportation, storage, and emplacement of radioactive materials at the site. We believe that a legislative solution to the land withdrawal issue would preclude the need for an extension or modification of the current administrative land withdrawal and allow important test programs involving TRU waste to proceed. An Administration bill has been introduced for land withdrawal. It includes conditions that the DOE must meet before the land withdrawal can take effect, including EPA approval of the Department's No-Migration Variance Petition, the completion of the FSAR and the ROD on the Final Supplemental Environmental Impact Statement.

The proposed FY 1991 budget for WIPP is intended to support operation of the WIPP facility and other related activities to conduct an experimental test program. This program will include bin and alcove radioactive tests, as well as an aggressive program to evaluate possible engineering modifications to assure compliance with the EPA disposal standards.

INTERIM STORAGE OF TRANSURANIC WASTE

We have also been deeply involved with the mixed TRU waste storage situation at the Rocky Flats Plant, located near Denver, Colorado. The delays attendant to the WIPP forced us to look at alternate storage sites for wastes generated at the Rocky Flats Plant. We are investigating three options: (1) storage at one or more DOE sites -- the Rocky Flats Plant, WIPP, LANL, ORNL, NTS, the Idaho National Engineering Laboratory (INEL), Savannah River Site (SRS), or the Hanford Reservation; (2) storage at a Department of Defense (DoD) facility; and (3) storage at a commercial site.

Waste minimization and volume reduction initiatives have been effective at the Rocky Flats Plant to extend the date when the permitted storage limit would be reached and either plant operations would have to be curtailed or offsite shipment would have to be initiated. We have been actively seeking the advice and counsel of all States potentially involved and have kept them abreast of our plans and progress. Secretary Watkins is committed to keeping the responsible State officials involved and informed.

HIGH-LEVEL WASTE VITRIFICATION

We continue to make progress in our plan to transition from tank storage of high-level waste at our Savannah River and Hanford sites, and at the West Valley site for which we have responsibility. We are transitioning from tank storage to more secure and environmentally acceptable storage of a glass waste form encapsulated in stainless steel canisters. The processes proposed for the three vitrification plants are based on the same technology. This technology is being used at waste processing plants in West Germany, France, Japan, and the United Kingdom. DOE will take full advantage of the applicable technology development at these facilities. An active technology exchange program has been established among the three U.S. vitrification plants for this purpose. Storage of the vitrified borosilicate high-level waste form will be provided on site until a Federal geologic repository is ready to receive defense waste.

The vitrification plants are being designed and constructed so that they will be in full compliance with Federal, State, regional, and local environmental policies for gaseous, liquid, and solid emissions. Requirements for all applicable environmental laws and regulations will be met.

DEFENSE WASTE PROCESSING FACILITY (DWPF)

The DWPF is located at the Savannah River Site near Aiken, South Carolina. There are approximately 34 million gallons of radioactive waste stored in underground tanks at the Savannah River Site. The high-level waste will be vitrified; the low-activity fraction will be solidified for on-site disposal. The facility is designed to produce a maximum of 410 glass-filled canisters annually, each of them containing approximately 165 gallons of vitrified waste. Production estimates show that once the facility is fully operational, it will take 12 to 16 years to process the backlog of accumulated wastes. Interim storage of the vitrified high-level waste at the Savannah River Site will be in a glass waste storage building. The storage building can hold approximately 2,300 waste-filled canisters, representing approximately 5 years of DWPF production. Eventually the canisters of glass will be transported to a Federal geologic repository.

The DWPF is nearing completion. Construction is currently estimated at 97 percent complete. The total estimated cost for construction is $930.2 million. In FY 1991, preoperational activities will continue in support of the anticipated 1992 vitrification facility hot startup. The hot startup will be preceded by extensive cold runs using nonradioactive simulated waste. Data from the cold runs will provide necessary information on waste form qualification, quality assurance, and personnel training.

Projects that provide direct support to the DWPF at the Savannah River Site are the Saltstone Manufacturing and Waste Facility (SMWF) and the Consolidated Incinerator Facility (CIF). The SMWF will treat and process the low-level radioactive salt solution fraction from the DWPF process. It will be stabilized in a concrete matrix and stored onsite in above ground RCRA-approved concrete vaults. The CIF is designed to incinerate liquid and solid hazardous mixed waste materials. The high temperature in the CIF rotary kiln will destroy the volatile hazardous organic waste stream, primarily benzene, generated by the DWPF vitrification process. Radionuclides are immobilized in a concrete matrix for onsite low-level storage. The SMWF has been completed, with $9.7 million requested in FY 1991 for startup and operations. The CIF design is undergoing hazard and safety analysis reviews and has a total estimated cost of $63.1 million. Scheduled completion of the CIF is the second quarter of FY 1992.

WEST VALLEY DEMONSTRATION PROJECT

A similar plant will be the West Valley Demonstration Project located near West Valley, New York. This effort will provide an integrated production-scale development and demonstration project for solidifying approximately 600,000 gallons of high-level nuclear wastes. It is anticipated that approximately 300 canisters of vitrified high-level waste will be produced during the 18-month waste vitrification campaign. The project, located on a site previously used for reprocessing spent nuclear fuel for commercial purposes, is currently using existing facilities to the maximum extent possible.

The high-level liquid waste is contained in underground storage tanks. The waste is comprised of a supernatant liquid above a sludge layer. The supernatant is currently being treated with expected completion of processing during FY 1991. The low-level liquid waste stream resulting from this treatment system is being immobilized in cement and stored at the site in a shielded cell. As of the end of CY 1989 about 50 percent of the supernatant volume has been processed. Installation and testing of sludge washing equipment will begin during FY 1991 after supernatant processing is completed.

Construction of the facility to store the vitrified high-level waste canisters will also begin during FY 1991. Waste vitrification will be conducted in late FY 1993.

HANFORD WASTE VITRIFICATION PROJECT (HWVP)

The HWVP facility housing the vitrification process equipment and support service will occupy an area of approximately 35 acres located southeast of B-Plant at the Hanford Reservation. Hanford stores approximately 20 million gallons of radioactive waste. The high-activity fraction of the high-level waste will be vitrified; the low-activity fraction will be solidified for on-site disposal. The waste will be pretreated in the B-Plant. Two waste streams will be produced during the B-Plant pretreatment step. One is the sludge resulting from concentrating the stored waste. The sludge will contain the bulk of the fission products and TRU elements. The other waste stream, much larger in volume, is the liquid from the concentrating process. Enough radioactivity will be removed from the large volume of liquid waste to permit disposal as low-level waste. The smaller volume of sludge will be sent to the HWVP for treatment. As with the product from the DWPF, the canisters of glass will be stored on site for eventual disposal at a Federal geologic repository. Construction is scheduled to start in the fourth quarter of FY 1991 and is scheduled to be completed in FY 1998. This would support the start of hot operations in FY 1999.

IDAHO HIGH-LEVEL WASTE TANKS

Evaluation of the existing high-level tank and vault systems at the INEL has confirmed that the present system cannot be modified to meet current environmental regulations and DOE Orders. This project provides for construction of four new 500,000-gallon capacity high-level radioactive waste storage tanks, plus upgrade of auxiliary systems and transfer lines for existing underground storage tanks. The Idaho Chemical Processing Plant (ICPP) high-level radioactive waste tank farm currently consists of eleven 300,000-gallon capacity storage tanks. Five of the existing tanks will be replaced by the four new tanks, which will be designed and built to meet RCRA regulations for hazardous waste tank systems, as well as applicable seismic and operational requirements.

Each tank will be constructed of stainless steel and have a secondary containment meeting all applicable regulations and seismic requirements. The secondary containment will have a sump with a system for detecting collected liquids. The vault will provide required radiation shielding. A vault ventilation system using blowers and high-efficiency particulate air (HEPA) filters will be provided to enhance early leak detection capability. Construction of the tanks will start in the fourth quarter of FY 1992 and be completed in the fourth quarter of FY 1998. The total estimated cost of the project is $270 million.

IDAHO CHEMICAL PROCESSING PLANT

Liquid radioactive wastes are produced from the reprocessing of spent fuel at the ICPP. A major portion of this recoverable irradiated fuel is from Navy propulsion reactors. These liquid wastes are stored temporarily in underground storage tanks prior to calcination in the New Waste Calcining Facility. The calcinined waste is stored in underground stainless steel bins pending final disposal. This waste, which is highly radioactive, is also classified as hazardous waste under current RCRA regulations.

COMPLIANCE AGREEMENTS

We believe that it is both proper and in our best interest to negotiate formal compliance agreements with the regulatory authorities who have jurisdiction over portions of our waste management operations programs. We have executed agreements at several of our sites with EPA and the cognizant State regulatory authority. We have multi-party agreements with the host State and EPA regional offices at several of our sites and have signed, or are pursuing, similar agreements at Idaho, Savannah River, Oak Ridge, and several other sites. In most cases, these agreements lay out a schedule to allow DOE to attain regulatory compliance on a workable schedule. We will continue to pursue such formal agreements as appropriate, in the belief that negotiated compliance agreements are preferable to unilateral enforcement actions by the regulatory authorities.

Many of the new construction projects requested in this budget are directly related to these agreements and our efforts to comply with the emerging regulations. In Idaho, for example, the existing high-level waste tanks cannot meet the RCRA regulations for hazardous waste tank systems, as well as the applicable seismic requirements. These will be replaced by new tanks which will meet all of the requirements. Construction of the Waste Receiving and Processing Facility at Hanford, which will provide treatment for stored and newly generated waste, is addressed in the Hanford Tri-Party Agreement. In general, strong emphasis will be placed on characterizing all DOE waste streams so that the development and planning of treatment and disposal facilities will be adequate to meet regulatory-driven requirements.

WASTE MINIMIZATION

DOE Order 5400.1 requires that we conduct operations in a safe and environmentally sound manner, incorporating national environmental protection goals in the formulation and implementation of its programs. Accordingly, all DOE programs are required to institute a policy to reduce the total amount of waste that is generated by DOE activities, with emphasis on reducing the amounts of radioactive, hazardous, and mixed wastes that need to be treated and disposed. In FY 1989, guidance for implementing the DOE waste minimization program was developed in conjunction with the EPA. In May 1990, each DOE facility is required to have in place a waste minimization plan and program. These plans will be reviewed and revised as required to assure that the Department has an effective overall program that leads to significant reductions in the amount of wastes that must be managed in the future. In FY 1991, the DOE Waste Minimization Program will focus on assisting DOE facility managers in identifying ways to reduce the amount of waste generated by process improvements, materials substitutions, recycling and recovery of useful materials from potential waste streams, and treatment of wastes to reduce the toxicity and mobility of pollutants upon disposal.

NATIONAL LOW-LEVEL WASTE PROGRAM

The National Low-Level Waste Program provides assistance to States and compact regions in developing new capacity for the disposal of low-level radioactive waste in accordance with Public Law 99-240, the "Low-Level Radioactive Waste Policy Amendments Act of 1985" (Act). Enactment of this legislation assigned individual States the responsibility for the disposal of low-level radioactive waste generated within their borders, with the exception of wastes generated as a result of certain Federal activities and low-level waste from licensed generators exceeding the limits established by the NRC for Class C low-level waste. The Federal Government is responsible for disposal of the excepted low-level waste. The formation of regional compacts among States to carry out their responsibilities is encouraged by the Act. To date, nine compact regions, incorporating 43 States, have been formed and consented to by the Congress.

During FY 1989, the National Low-Level Waste Program carried out the reporting and administrative activities required in the Act and focused on meeting the generic technical needs of the States and compact regions as they worked to select sites and develop new disposal facilities. In FY 1990, DOE continues to provide technical assistance to States and compact regions as provided by the Act to support the selection and development of new low-level disposal facilities. DOE is currently developing a strategy for acceptance and disposal of greater-than-Class-C low-level waste from licensed generators in accordance with requirements of Public Law 99-240.

In FY 1991, the Department proposes to continue assistance to States and compacts and to provide for acceptance of limited amounts of greater-than-Class-C low-level waste for storage and disposal. Development of a dedicated storage facility for general acceptance of greater-than-Class-C low-level waste will begin.

Public Law 99-240 makes States responsible for disposal of low-level waste and assigns responsibility to DOE for providing technical assistance to the States to help them fulfill this responsibility. Recently, a number of public officials have urged that Congress amend the Act in view of the declining volume of low-level waste being generated. Some have urged that the Department take action to reduce the number of planned disposal sites. These officials point out that, from an operational standpoint, more disposal facilities are being developed than may be economically justified to dispose of the Nation's low-level waste. Secretary Watkins, during his May 1 appearance before the Senate Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, stated that any effort to alter the framework provided by Congress in its enactment of Public Law 99-240 must come from the States themselves, although the Department could provide technical assistance to the States to analyze a process for evaluating options available to the them.

ENVIRONMENTAL RESTORATION

The objectives of the Environmental Restoration Program are to perform remedial action and decontamination and decommissioning at contaminated DOE and legislatively authorized non-government facilities and sites; conduct assessments and characterization of DOE sites to determine if there is a potential for radioactive and hazardous waste releases; and to protect human health and the environment and return the facilities and sites to productive use, where appropriate. This program consolidates all remedial action and decontamination and decommissioning activities previously budgeted under the Office of Defense Programs; the Office of Nuclear Energy and the Office of Energy Research. The goal of the Environmental Restoration Program is the cleanup of these sites within 30 years. This goal supports the Department's policy of compliance with the letter and spirit of applicable Federal, State and local health, safety, and environmental statutes. Successful execution of this program is a key part of the Department's commitment to continue to protect public health and safety and to assure a safe and clean environment in connection with its activities.

The requested funding for the Environmental Restoration Program is distributed among the program elements as indicated in the following table.

ENVIRONMENTAL RESTORATION FUNDING SUMMARY

($ in Thousands)

	FY 1990 APPROPRIATIONS		FY 1991 REQUEST	
	Total	Defense Related	Total	Defense Related
Facilities and Sites	$548,567	$506,540	$720,720	$633,215
Formerly Utilized Sites Remedial Action Project	14,643	0	36,200	0
Uranium Mill Tailings Projects	$ 93,619	$ 0	$125,500	$ 0
TOTAL	$656,829	$506,540	$882,420	$633,215

FACILITIES AND SITES

The Facilities and Sites activity conducts remedial actions and decontamination and decommissioning (D&D) projects to reduce and remove the potential risks to the environment and to human health and safety resulting from past Department activities. The program objective is to protect human health and the environment and return the facilities and sites to productive use, where appropriate.

The remedial action requirements are derived primarily from CERCLA, the Superfund Amendments and Reauthorization Act of 1986 (SARA), and RCRA. The program consists primarily of activities related to remediation of inactive waste disposal sites, uncontrolled release sites, and underground storage tanks. Work scopes, project schedules, and cleanup standards for these activities are negotiated with EPA and the States and are the subject of RCRA permits, Consent Orders and Compliance Agreements, and CERCLA Federal Facility Agreements.

The Facilities and Sites activity FY 1991 budget request indicates significant percentage growth over FY 1990 in the funding proposed for cleanup activities, particularly those associated with CERCLA. The percentage spending for assessment and cleanup activities remains relatively constant over the FY 1989 through FY 1991 period -- that is, about 60 percent and 40 percent, respectively. However, projections for the outyears, as shown in the Five-Year Plan, indicate that these percentages are predicted to reverse by FY 1995, with cleanup activities expected to account for approximately 60 percent of expenditures.

There are several areas of intense effort in FY 1990 regarding completion of cleanups under RCRA corrective action requirements and acceleration of assessment activities under both RCRA and CERCLA. These activities, described below, are responses attributable to the Department's interaction with State and EPA regulators in negotiations that have put or are about to put into place Interagency Agreements or Agreements in Principle which are being negotiated on a voluntary basis with all the States that host Departmental facilities. The model for such agreements is the Agreement-in-Principle signed between the Department and the State of Colorado in June 1989. These agreements provide for funding for the State and formalize the Department's commitment to increased oversight and monitoring by the State of DOE's activities. The funding for these State monitoring agreements is consistent with the general authorities vested in the Department under the Atomic Energy Act.

At the Rocky Flats Plant in Colorado, the Department agreed to accelerate remedial actions associated with the 881 Hillside, the 903 Pad Area, and the Solar Ponds. These interim remedial actions were to start by the end of FY 1989, or as soon as the regulatory process would allow. Action on all three areas is underway. An Environmental Assessment under the National Environmental Policy Act (NEPA) for the 881 Hillside ultraviolet/peroxide and ion exchange treatment system was performed in August 1989 and issued by the Department in January of this year. Construction of the system also started in January and operation is expected to commence by the end of this year. A remedial investigation for the 903 Pad Area was started in July 1989 and is scheduled for completion in FY 1993. Interim remedial action on the pad is currently being delayed through agreement with the regulatory agencies, while additional data is being collected. For the Solar Ponds, the Department is following the direction of the State for removal of materials and treatment of groundwater per the approved closure plan.

At the Feed Materials Production Center (FMPC) in Ohio, three interim remedial actions are currently being pursued. These address offsite groundwater contamination, perched groundwater under onsite buildings, and onsite uranium storage silos. All three of these actions currently involve characterization or preliminary engineering activities.

At the Oak Ridge Reservation in Tennessee, the Department has completed RCRA closures for eight former waste disposal facilities at the Y-12 Plant and interim closure of Solid Waste Storage Area 6 unlined waste storage trenches in FY 1989. Groundwater characterization is currently ongoing and will be used to help determine final closure requirements.

We are making significant progress achieving more specific agreements with Federal and State regulators regarding cleanup activities at our sites. As of the end of FY 1989, the Department had signed 43 interagency agreements, including Federal Facility Agreements (FFAs), Federal Facility Compliance Agreements (FFCAs), Settlement Agreements, and Consent Orders, and the aforementioned Agreement-in-Principle with Colorado for State environmental monitoring. Notable among these agreements are the Tri-Party Agreement for the Hanford Reservation, the three party agreement under CERCLA for the Lawrence Livermore National Laboratory (LLNL), and the tri-party agreement under CERCLA for the Monticello Mill Site/Vicinity Properties.

Since the publication of its Five-Year Plan, the Department has executed a Notice of Intent to Sign a tri-party agreement with the State of Colorado and EPA Region VIII for the Rocky Flats Plant. This agreement updates requirements for cleanup of the facility identified in a tri-party agreement executed in July 1986. The Department has completed negotiations with State and Federal regulators for two interagency agreements which will cover four of the Department's more notable facilities from a cleanup perspective -- the FMPC and the three Oak Ridge facilities in Tennessee (the Y-12 Plant, ORNL, and the Oak Ridge Gaseous Diffusion Plant). These agreements are in the final stages of review and are expected to be signed shortly. The Department is also nearing completion of an FFA with the State of South Carolina and EPA Region IV for the Savannah River Site. Finally, the Department has just initiated negotiations with the State of Idaho and EPA Region X for remediation of the INEL. This agreement will supersede the requirements contained in the Consent Order Compliance Agreement for this facility signed in 1987.

Much of the FY 1991 budget request for the Facilities and Sites activity is directly related to the enforceable requirements of existing and anticipated agreements. In late 1989, 12 additional DOE installations were listed on the EPA National Priorities List (NPL). Under CERCLA, interagency agreements will be required prior to proceeding with major cleanup activities on the sites associated with these installations.

The Facilities and Sites activity contains the Decontamination and Decommissioning Program, which provides for the safe management and disposition of surplus facilities radioactively contaminated from DOE activities. The decontaminated facilities are to be released for use without radiological restrictions. The program currently includes over 250 projects at 33 sites in 17 States. Decommissioning activities have been completed at 21 projects in the program. There are 26 active D&D projects underway currently and many facilities will require surveillance and maintenance until actual decommissioning work begins. Additional projects are expected to be included in the program as presently operating facilities become surplus. Decommissioning of the Shippingport Atomic Power Station, which began in September 1985, was completed in early FY 1990. The project was completed ahead of schedule and under budget. This project successfully demonstrated decommissioning of the Nation's first commercial nuclear powerplant.

The Weldon Spring Remedial Action Project in Missouri, designated a Major Systems Acquisition by DOE, has an approved FFA with EPA. The project involves the remediation of a 231-acre Feed Materials Plant which supported former Atomic Energy Commission efforts and was also used for ordinance activities by the Department of the Army. Work this year involves carrying out some interim actions which include construction of a waste water treatment facility, characterization activities, and continued preparation of a Remedial Investigation/Feasibility Study (RI/FS).

The Department also has a FFA on the Monticello Remedial Action and Vicinity Properties Projects in Utah. A CERCLA Record of Decision has been issued for the Vicinity Properties Project. DOE expects to issue a Record of Decision for the Remedial Action Project during the third quarter of FY 1990. At this time, 65 of 112 authorized vicinity properties have been remediated. More properties are expected to be surveyed and authorized during the next 2 years. For the Remedial Action Project, a Final RI/FS is expected to be issued in mid-FY 1990.

The Battelle Columbus Laboratory (BCL) Decommissioning Project in Ohio involves the decontamination and release of 15 buildings radioactively contaminated during work conducted by Battelle under contract to DOE. Most of the buildings are currently under surveillance and maintenance. Planning and characterization activities are currently underway. Approved interim actions have been taken at two buildings resulting in their independent certification and release for use without radiological restrictions. The majority of the work will begin at the end of FY 1990 after approval of an Environmental Assessment.

Other activities in FY 1991 will include cleanup efforts at the Argonne National Laboratory in Illinois, the Santa Susana Field Laboratory in California, the Mound Laboratories in Ohio, ORNL in Tennessee, LANL in New Mexico, INEL in Idaho, the Savannah River Site in South Carolina, the Hanford Reservation in Washington, and other DOE reservations and remote sites.

The Environmental Restoration Program has made significant progress over the past year in identifying and prioritizing its needs for the next 5 years. In addition to meeting the challenges of existing and anticipated regulatory requirements, the Department is looking to the future by undertaking actions to facilitate the smooth and efficient operation of the Environmental Restoration and Waste Management programs. These include development of a Programmatic Environmental Impact Statement (PEIS) for all activities addressed in the Five-Year Plan, development of a centralized database to facilitate program management and information exchange both within and outside the Department, and innovative contracting mechanisms for remediation work at our field installations. While the PEIS is not expected to be completed until FY 1993, planning and public scoping is expected to be complete before the end of FY 1990. The database efforts and streamlined contracting procedures are expected to be in place to support program activities by the end of FY 1991.

We face many difficult challenges in the years ahead, both in terms of the sheer magnitude of the cleanup problem and in terms of the need for technological breakthroughs to accomplish cleanup in a timely, cost-effective, and environmentally compliant manner. The Department needs to continue its dialogue with the Federal and State regulators and with the public to be flexible in its response to new findings and regulatory requirements, and to be innovative in its approach to solving some of the most complex and difficult cleanup problems ever faced by this nation.

TECHNOLOGY DEVELOPMENT

The primary mission of the Technology Development program is to establish and maintain an aggressive national program for applied research, development, demonstration, testing, and evaluation (RDDT&E). The principle objective of the program is to resolve major technical issues and rapidly advance beyond current technologies for environmental restoration and waste management operations. The program is directed to support activities under the Office of Environmental Restoration and Waste Management.

This program mission supports the Department's 30-year compliance and cleanup goal by: (1) establishing the management process for funding technologies at their various stages of development and deployment for better, faster, and more cost-effective interim and permanent solutions to environmental problems; (2) conducting an innovative, aggressive technology development program for waste management, waste minimization, waste treatment, storage, and disposal; (3) developing more effective remediation technology for restoration of contaminated sites and facilities; (4) developing technologies to reduce occupational and public exposure; (5) establishing a coordinated education program involving universities, DOE national laboratories, and industry to train the people needed to address DOE's Environmental Restoration and Waste Management problems; (6) promoting technology transfer and outreach among the Department, the private sector, and other governmental agencies; (7) ensuring the safe, secure, and economical transportation support for program activities.

The Technology Development program provides the innovative technology, its progressive development, and its demonstration to make available new technology for environmental cleanup and restoration, decontamination and decommissioning, and waste management including minimization and disposal.

The FY 1991 budget request for Technology Development activities follows.

TECHNOLOGY DEVELOPMENT
FUNDING SUMMARY

($ in Thousands)

	FY 1990 APPROPRIATIONS		FY 1991 REQUEST	
	Total	Defense Related	Total	Defense Related
Applied Research and Development	$ 39,840	$ 39,840	$ 39,840	$ 39,840
Demonstration, Testing and Evaluation	99,609	99,459	94,409	93,909
Education	20,685	20,685	27,731	27,731
Capital Equipment	3,347	3,347	16,820	16,820
All Other	$ 20,000	$ 20,000	$ 27,200	$ 22,000
TOTAL	$183,481	$183,331	$206,000	$200,300

During FY 1990, the *Applied Research, Development, Demonstration, Testing and Evaluation Five-Year Plan* was prepared by DOE and submitted to Congress, the States, and the public. This planning document described the need for new and innovative technologies, assessed the current state of technologies, and outlined the elements of a national program to reduce risk to human health and the environment, decrease cost, and achieve a 30-year cleanup goal. The RDDT&E Five-Year Plan is being consolidated into the first annual update of the Environmental Restoration and Waste Management Five-Year Plan.

Technology Development was organized as a separate supporting effort in FY 1990 and provided a significant increase in funds to accelerate needed developments on high-priority problems (that is, those requiring better, more permanent solutions). Emphasis is placed on improved or new technology for characterization of sites to determine the magnitude and extent of contamination spread and its physical and chemical nature. Industrial, university, and DOE laboratory methods are being studied for the most capable and effective restoration and treatment techniques which can be applied to a broad range of DOE site problems. Establishing a separate technology development program provides the focus of scientific talent to effectively screen available and evolving technologies and provide demonstrated and proven methods for use.

At the heart of RDDT&E implementation is our goal to utilize a broad base of expertise in Federal and State agencies, national laboratories, industry, and universities. Our challenge is to focus the creativity in these institutions on creative, problem-solving R&D and technology development. Consequently, we are providing incentives that will encourage the submittal of cooperative, multi-institution proposals.

We envision a "developmental cycle" in which applied R&D would be carried out primarily at the National Laboratories and universities. These efforts would be supported by industry in the development of innovative technology, for example, for ground water remediation and in situ stabilization of wastes. When a technology enters the demonstration phase, the laboratories would be teamed with industrial partners to provide cleanup demonstrations at DOE and private sector sites. In the final phase of the cycle, technology would be transferred to industry for wide-scale application at sites requiring remediation.

Applied R&D activities have been initiated, for example, to pursue alternative technologies to minimize the quantity and/or toxicity of waste streams, to evaluate the cost effectiveness of separating slightly contaminated waste for alternate, less costly, disposal, to test supercritical water oxidation processes for waste treatment and to develop design concepts for fiberoptic monitoring of organic hazardous wastes.

Demonstration activities are underway for treatment and disposal of reactive materials, waste acid detoxification and remediation, in situ vitrification, and plasma arc processing to destroy hazardous organic materials. An integrated demonstration test bed is being established at the Savannah River site where DOE laboratories, universities and industry can demonstrate technologies for removal of organic chemicals from soil and groundwater.

Many observers have noted the shortage of professionals in the environmental restoration and waste management areas. The shortage is even more acute in the RDDT&E disciplines that support cleanup authorities. For this reason, we will vigorously support education programs to meet present and future personnel needs. We are taking the long view that we want to assure that a knowledgeable talent pool will exist to complete DOE's cleanup program in 30 years. Two major university consortia have already been established to support our office -- one in New Mexico and a second in South Carolina. In order to take maximum advantage of similar R&D activities being conducted by other Federal agencies, we have established partnerships with EPA, DoD, and the National Institute of Standards and Technology (NIST, formerly the Commerce Department's National Bureau of Standards). Additional collaboration is planned with the National Aeronautics and Space Administration (NASA), the National Oceanic and Atmospheric Administration (NOAA), and the Department of Health and Human Services (HHS).

As an example of our interagency collaboration, we have initiated our first cooperative technology demonstration project with the EPA. The project, a plasma arc furnace, is to demonstrate the thermal destruction and immobilization of hazardous wastes and contaminated soils. This plasma technology offers cost savings in hazardous and mixed waste treatment and immobilization of heavy metals and radionuclides.

Our request for Technology Development for FY 1991 is $206.0 million, a 12 percent increase over FY 1990. An increase of $7.0 million is requested for educational development to expand on initiatives begun in FY 1990. Two additional university partnerships will be established. Additional scholarships and fellowships in environmental restoration and waste management disciplines will be supported. Workshops on FY 1990 outreach activities will be conducted, and program expansion developed based on lessons learned. Applied R&D and demonstration, testing and evaluation activities begun in FY 1990 will be evaluated for continuation. Promising new initiatives will replace efforts that have less potential for impacting key environmental restoration and waste management problems.

The capital equipment request reflects a significant increase, $13.5 million, to establish an equipment budget for technology development. RDDT&E equipment is required in such areas as pilot-scale robotic waste handling, in situ vitrification, remote exhumation of buried mixed waste, analysis and monitoring.

PROGRAM DIRECTION

In November 1989, the Office of Environmental Restoration and Waste Management was established to manage and direct Five-Year Plan activities. A primary reason for consolidating environmental management functions under one organization is to provide centralized management and planning for more focused control and validation of costs, schedules and prioritization of projects. The FY 1991 budget request provides for a staffing level of 116 full-time equivalents (FTEs) at Headquarters and an additional 85 FTEs located at four DOE Operations Offices. Program Direction is to fund employee salaries, benefits, overtime, contract support, travel, printing and reproduction services.

PROGRAM DIRECTION
FUNDING SUMMARY

($ in Thousands)

	FY 1990	FY 1991
Headquarters	$ 4,980	$ 19,939
Operations Offices	570	4,167
TOTAL	$ 5,550	$ 24,106

The budget request provides for only the essential staff levels needed to continue to build an organization responsible for aggressive implementation of the activities described in the Five-Year Plan.

CONCLUSION

DOE is making progress in developing a systematic, focused course of action to address its environmental problems. On-going activities and recent initiatives include implementation of the Secretary's 10-point environmental protection plan, the continued negotiation of federal facility agreements, and implementation of an overall framework for conducting specific environmental-related activities, the Environmental Restoration and Waste Management Five-Year Plan.

The Plan reflects the goal to clean up and restore the environment at its nuclear sites within 30 years. While progress may appear slow to some, we are convinced that credibility is going to be the key. This credibility will come

through implementation of the Five-Year Plan. One significant element of this planning initiative is that DOE has sought the assistance of outside groups previously considered as adversarial to the operation of DOE facilities in preparing its Five-Year Plan. The utilization of these outside groups is a hallmark of the Secretary's tenure at DOE. It represents a significant change in the way the Department conducts its business. Achieving progress in implementing these measures will go a long way toward gaining public acceptance of our ability to manage and operate DOE-owned facilities safely and in an environmentally-sound manner. Only through this difficult process will DOE, as an institution, assume its proper role as a good neighbor and protector of the environment. We believe that DOE can and will be able to achieve its important national security objectives while complying with this nation's environmental laws.

SUPPLEMENTAL STATEMENT
SUBMITTED BY THE
U. S. DEPARTMENT OF ENERGY

Mr. Chairman and members of the Committee, I am pleased to submit an overview of the status of the New Production Reactors Program and our budget request for FY 1991. The mission of our program is clear: to design and construct new production reactor capacity for an assured supply of nuclear materials, primarily tritium, to maintain the Nation's nuclear deterrent capability.

With the support of the Congress, we have embarked upon a course of action to ensure that these nuclear materials will be reliably produced in a safe, secure, and environmentally sound manner and in adequate amounts to meet national security requirements. This is both a necessary and ambitious endeavor, and we must make certain that our national security policies are not undermined and that all future defense policy options remain open.

To accomplish this mission, the Department's preferred strategy is to proceed with the design and construction of a Heavy Water Reactor (HWR) at the Savannah River Site and to design and construct a Modular High-Temperature Gas-Cooled Reactor (MHTGR) at the Idaho National Engineering Laboratory. As a contingency, work is to continue on the development of a Light Water Reactor (LWR) tritium target.

This strategy fully embraces the concept of duality -- using two different technologies at two different sites -- which will provide the highest assurance of reliable supplies of tritium. It is imperative that this vital concept of duality remains because it is the cornerstone of our strategy for providing assurance of production capacity for the future.

Until the final EIS and subsequent Record of Decision are issued in late 1991, the Department of Energy (DOE) will still consider all reasonable options concerning replacement production capacity. However, DOE still strongly supports the preferred strategy and will continue to pursue it on an expeditious schedule. Certainly we all endorse the prospects for peace that are sweeping our world today, but preparedness should remain as our watchword. As Secretary Watkins has stated, "Flexibility to meet contingencies, duality, and improved capability are goals that can and should be achieved."

The critical nature of the current tritium supply and the specter of what would be, in effect, unilateral disarmament if that supply could not be replenished, is our driving force. This program will eventually provide replacements for the current production reactors, and continues to be the centerpiece for modernization of the Department of Energy's nuclear weapons complex as we move into the Twenty-First Century.

The New Production Reactors Program (NPR) is well underway and we have made significant strides toward meeting our objectives. Continued strong support from the Congress will allow us to build upon the progress made so far and will enable the Department to obtain the data required to make a decision about the preferred technologies and sites for new production capacity. I would now like to provide you with a brief background description of tritium production and the vital need to ensure that the New Production Reactors Program continues forward.

Tritium, a radioactive isotope of hydrogen, is an essential ingredient in our modern nuclear weapons and is lost rapidly through natural radioactive decay. Its half life of 12.3 years equates to a loss of 5.5 percent per year of our total inventory. It must be regularly replenished or the weapon's effectiveness is dramatically reduced.

The only proven, practical method of producing tritium is the irradiation of targets in nuclear reactors. This has been acknowledged in previous studies which considered the need for construction of replacement capacity. Since the early 1980's, reports and studies have recommended that new production capacity be constructed to meet the need for replacement capacity.

The idle P, K, and L Reactors at the Savannah River Site are the Nation's only source of tritium for defense purposes. As you know, they remain shut down to allow for needed safety and operational improvements. When new reactors are constructed and ready to operate, the Savannah River Site reactors will be approximately 45 years old.

In recognition of the accelerated need for replacement capacity, and after careful analysis and consultation concerning technology and sites, DOE issued a report to Congress on August 8, 1988, announcing the Department's strategy for acquiring new nuclear materials production capacity. Since that report to Congress the Department's preferred strategy has remained unchanged.

The preferred strategy selected was based on an assessment of candidate technologies made by the Energy Research Advisory Board (ERAB); an evaluation of candidate DOE sites conducted by a Site Evaluation Team; an evaluation of comparative costs by the NPR Capacity Cost Evaluation Team; and consultations made with key agencies within the Administration, such as the Department of Defense, Office of Science and Technology, the National Security Council, and the Nuclear Weapons Council. A final decision on technologies and sites will be made by the Secretary of Energy after the completion of an Environmental Impact Statement (EIS). This formal Record of Decision is scheduled for late 1991.

As stated earlier, the preferred strategy embodies the concept of duality - a two reactor strategy, which will provide the highest assurance of reliable supplies of tritium. ERAB examined duality in its study and found that a multiple reactor strategy, utilizing diverse technologies and separate sites, would produce high production assurance, reduce uncertainties in the schedule leading to production of materials, and minimize risks to national security. The rationale for two technologies is that it reduces the risk of losing total production capacity due to unforeseen safety or technical problems generic to one design or due to design specific regulatory or institutional changes. It also offers flexibility in production capability. Multiple sites reduce the risk of loss of capability by site specific, naturally occurring events or site specific institutional or regulatory problems.

The Department is in the process of preparing Conceptual Designs and an Environmental Impact Statement to support programmatic decisions regarding sites and technologies for the NPR program. Three reactor technologies - light water, heavy water, and modular high temperature gas-cooled - are intended to be maintained as viable options until we obtain more technical data, improve cost and schedule estimates, and complete the Environmental Impact Statement review process. We are currently estimating that the Department will be able to select the best technology and sites for the NPR program by late 1991.

Substantial progress has been made in implementing this strategy. The Office of New Production Reactors was established on October 1, 1988 with its sole mission being the safe and environmentally sound construction of new production reactor capacity. This program has the unique task of coordinating and managing all Departmental activities associated with the design and construction of these reactors. The organizational philosophy of the NPR Program reflects the new approach initiated by the Secretary which calls for strong central control with increased safety, environmental, and quality assurance oversight. Separate Engineering Technology Offices for HWR, MHTGR, and LWR have been established and will maintain technical control throughout the life of the Program. Also, I have created oversight Offices for Safety and Quality and for the Environment. Finally, Project Management Offices will be established at each of the three project sites with the Project Officer reporting directly to the Director of the Program. Safety, Quality, and Environmental Field Representatives will be located at each of the three sites to serve their respective NPR Headquarters' Offices.

In keeping with Secretary Watkins' direction for strong headquarters control, the New Production Reactors Program organization has been put in place with clear lines of responsibility and authority designed to efficiently and effectively carry out our mission.

In addition to the establishment of a solid organizational structure, current activities include supporting an extensive National Environmental Policy Act (NEPA) process. The Implementation Plan for developing an Environmental Impact Statement was issued by the Department this January and work will continue on preparing the draft EIS which we expect to be available for public review and comment in early 1991.

A safety review plan has also been developed to make certain that the highest principles of safety assurance are incorporated in the planning and are adhered to in the design and construction of the new production reactors. We will be working with the Defense Nuclear Facilities Safety Board, established by the Congress, and we are also working closely with the Department's Advisory Committee on Nuclear Facility Safety, which is currently directly involved in the review of the steps to be taken in safety assurance.

We have taken steps to incorporate sound technical management principles. These steps included the retention of a Utility Engineering Group, Duke Engineering and Services, Inc., and preparation of a comprehensive Program Plan and a detailed Technical Requirements Document. Duke Services will lend considerable commercial sector experience and expertise in all facets of the design, construction, and operation of the new production reactors. The Program Plan provides a baseline of the entire program including strategies, milestones, quantitative technical goals, time-phased objectives and resource requirements. Finally, the Technical Requirements document provides an authoritative, single-source set of baseline technical and engineering requirements. This document will be used throughout the life of this program.

The award of contracts in November 1989 for design of the HWR and MHTGR was a major milestone for the Program. Conceptual design, the first design phase, will be completed this summer and will provide the Department with budget quality cost and schedule data which will be used by the Secretary in making a final decision of the technologies and sites. Design contracts were awarded to two consortia for the design of the HWR, Ebasco Services, Inc. (Babcock & Wilcox, Combustion Engineering, Rockwell International, and Battelle) and Westinghouse - Bechtel and one consortium for the design of the MHTGR (Combustion Engineering and General Atomics - CEGA). Following completion of the conceptual designs for the HWR one design team will be selected to proceed with preliminary design. The HWR preliminary design will start in the fourth quarter of FY 1990 following the final contract selection process. The MHTGR designer is expected to start preliminary design (Title I) in the third quarter of FY 1990, ahead of schedule.

Much has been accomplished over the past year and I believe that we have laid the foundation for continued success. In the immediate future we will proceed with the environmental activities necessary for preparation of a draft EIS and, concurrently, with development, confirmatory testing and project design efforts. The pace of activities is increasing and is aimed at supporting detailed design and construction as soon as possible after a Record of Decision has been issued.

Funding in FY 1989 and FY 1990 has been at a level sufficient for initiation of design activities, analyses, continuation of the NEPA process, and confirmatory development work. The requested FY 1991 funding level of $363M, consisting of $132.9M in operating budget authority and $230.1M in capital (design) funds, is essential to support the continued broad range of activities necessary to bring new production reactor capacity on line safely, with high assurance and on a timely schedule. With the initiation of preliminary design for both reactor technologies and acceleration of the design and construction of support facilities, funding is becoming a critical factor. To maintain the pace of activities necessary to meet our schedules both near and long term, full funding of the Department's request is vitally important. The FY 1991 operating budget levels are required for the following activities:

- For confirmatory development, we are requesting $25.8M ($16.6M for HWR and $9.2M for MHTGR). This funding will be used to continue verification of design and safety requirements.
- Tritium target development funding will increase to $49.7M ($26.2 for MHTGR and $23.5 for LWR). This funding will be used for continued irradiation testing in DOE's Advanced Test Reactor and further diagnostic efforts.
- We have requested $8.3M which will be used to issue a draft EIS, conduct public hearings, resolve public comments, and prepare the final EIS.
- We have requested $16M to continue implementation of the safety review process, including the refinement of safety requirements and the continued independent reviews of safety issues and documentation resulting from design activities.

The NPR will require 115 Full-Time Equivalents in 1991. Our request of $33.1M for Program Direction and Support reflects an influx of the highly skilled expertise necessary to perform the design, safety and environmental functions described above and to manage a program of this magnitude. In addition, these funds will provide for: safety, QA, environmental, and design reviews; acquisition of data processing equipment and software; administrative activities; and contractor support to the NPR.

We are also seeking $230.1M in capital (design) funds in FY 1991 to continue with facility engineering and preliminary design. Conceptual designs will have provided detailed assessments of major concept issues and trade off studies and evaluations, identified engineering development requirements, developed improved cost estimates, and provided an initial project schedule. Preliminary (Title I) design, to be initiated in FY 1990, will take the baseline established in the Conceptual Design Report and the Requirements Document and will further define the requirements and criteria which will govern the detailed design. Title I design, which will continue through FY 1991, will be funded using construction (design) monies although no actual construction would take place until after the Record of Decision. In FY 1992, we plan to initiate Title II design, long lead procurement, and design of support facilities.

Mr. Chairman, in conclusion, I stated earlier that this was an ambitious endeavor that is absolutely essential. Our request of $363M for FY 1991 is needed to continue our mission of providing new production capacity on an expeditious schedule for eventual replacement of our current tritium supply system. Because of this, I know that the Department and the President place a high priority on the program I have just outlined. In a little over a year, we have assembled a highly qualified staff to manage this program and are continuing to seek additional qualified personnel. We have made substantial progress in advancing the NEPA process and will have completed the EIS by the end of 1991 as we move towards the Record of Decision. Your assistance in assuring adequate funding has also enabled us to retain the services of the best the commercial nuclear industry has to offer, set up stringent safety and quality assurance requirements, and most important meet our schedule of commencing conceptual design. Your continued assistance in assuring adequate funding is essential to the success of our mission of assuring the Nation a safe and reliably sound nuclear deterrent.

* * *

SCIENTECH INC.
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301/468-6425 (FAX 301/468-0883)

May 22, 1990

Mr. John C. Tuck
Under Secretary
U.S. Department of Energy
Washington, D.C. 20585

SUBJECT: RJM-94-90: Letter Report Regarding EG&G's Response to the SCIENTECH Report, "An Assessment of Criticality Safety at Rocky Flats Plant"

Dear Mr. Tuck:

As requested by the Department of Energy, SCIENTECH, Inc. assembled an independent Team of experts to review the EG&G Rocky Flats Action Plan which responded to the Criticality Safety Assessment performed by SCIENTECH, Inc. from July to September 1989.

The Team conducted its review of the EG&G Action Plan from May 7 to May 21, 1990. During the week of May 7, 1990, the Team convened at the Rocky Flats Plant to inspect particular areas of the facility and to meet with cognizant EG&G and DOE/RFO personnel.

The preliminary results of the Team's review of the most significant recommendations are contained in the enclosed report. SCIENTECH, Inc. expects to issue a final report within the next two weeks. The final report will address each item in the EG&G Action Plan.

Sincerely,

Roger J. Mattson ([illegible])

Roger J. Mattson
Team Leader,
Criticality Safety Assessment Team

Enclosure: As stated

cc: Acting Assistant Secretary for Defense Programs,
U.S. Department of Energy
Victor Stello, Jr., Defense Programs, U.S. Department of Energy
Tim Holeman, Office of the Governor of Colorado
Robert Nelson, Jr., U.S. Department of Energy,
Rocky Flats Area Operations Office
B. P. Warner, General Manager, EG&G Rocky Flats Plant

file: 2006-28

SCIE-DOE-202-90

A Review of EG&G's Response to SCIENTECH's 1989 Report:

"An Assessment of Criticality Safety at Rocky Flats Plant"

Letter Report
Prepared by SCIENTECH, Inc.

Under DOE Contract
DE-ACO1-88EH79081

INTRODUCTION

In April 1990, SCIENTECH was asked by the U.S. Department of Energy (DOE) to assemble an independent team of experts to review the EG&G Rocky Flats Action Plan, which was developed in response to the Criticality Safety Assessment performed by SCIENTECH, Inc. from July to September 1989. The purpose of the review was to provide assurance that Rocky Flats Plant management and workers understand the fundamental issues associated with the recommendations made in the Criticality Safety Assessment Report of September 1989 and that appropriate corrective actions have been developed and will be implemented to resolve these issues. In addition, the Team evaluated the responses to the recommendations that came under the purview of the DOE Rocky Flats Area Operations Office (DOE/RFO).

The Criticality Safety Assessment Team met at the Rocky Flats Plant the week of May 7, 1990. During this site visit, the Team conducted a detailed review of the EG&G Action Plan, inspected various areas of the plant, and conducted numerous interviews and meetings with EG&G personnel.

EG&G's Action Plan was originally issued on February 16, 1990. The Action Plan reviewed by the Team was dated May 4, 1990. This revision of the Action Plan responded to comments made by DOE/RFO on April 19, 1990.

During its review of the Action Plan dated May 4, 1990, the Team found some instances where its earlier recommendations were not fully understood by Rocky Flats personnel. Consequently, the Action Plan did not address all of the issues associated with the Team's original recommendations. In those instances where the Action Plan was judged to be deficient, the Team made suggestions to EG&G for modifying the Action Plan to address the recommendations more completely. DOE/RFO also provided additional comments on the EG&G Action Plan during the Team's review. EG&G's response to the comments made by DOE/RFO and the SCIENTECH Criticality

Safety Assessment Team have been incorporated into the May 16 version of the EG&G Action Plan.

In the course of its review, the Team had occasion to discuss safety matters with a number of people at the plant, including managers, engineers, and line supervisors. The attitude toward criticality safety has definitely changed at the Rocky Flats Plant since the Team's visit last summer. Management has placed a higher priority on criticality safety matters and this has been communicated down into the organization. Changes still need to be implemented, but plant personnel have a positive attitude toward accomplishing these changes.

GENERAL OVERVIEW OF EG&G ACTION PLAN

Generally, the May 16, 1990, version of the EG&G Action Plan for Criticality Safety is considered to be responsive to the recommendations made in September 1989 by the Criticality Safety Assessment Team.

The actions already taken by EG&G and the actions and practices proposed for the future, if fully implemented, will reduce the probability of a criticality accident at the plant and maintain an acceptably low level of risk to the workers and public. The criticality safety measures that were in place in 1989 have been upgraded, especially those that guard against inadvertent accumulation of unsafe quantities of plutonium in ventilation ducts.

The EG&G Action Plan for Criticality Safety demonstrates the following:

- EG&G understands the recommendations of the Criticality Safety Assessment Team.
- Actions taken or planned by EG&G should prove to be effective in responding to the recommendations.
- The timing of actions taken or planned by EG&G is adequate.
- The resources required for short-term and long-term actions have been identified.
- An organization has been established within EG&G to monitor, among other things, implementation of the planned actions for criticality safety improvements.

IMPORTANT ISSUES IN EG&G ACTION PLAN

EG&G Nondestructive Assay (NDA) Program

One of the most significant problems uncovered by the Criticality Safety Assessment Team in 1989 was the gradual buildup (sometimes referred to as holdup) of plutonium and other materials in glovebox ventilation ducts at locations downstream of the glovebox prefilters. This buildup, although a concern for worker safety, occurs upstream of the multiple banks of high-efficiency filters that prevent release of hazardous materials to the environment. Thus, it does not pose a significant hazard to public safety. However, it is conceivable that if care is not exercised, enough fissile material could gradually collect or suddenly migrate (e.g., during an earthquake or because of inadvertent flooding of a ventilation duct) such that a critical mass would form. The radiation associated with such an accidental criticality could affect the health of workers in the immediate area and might be fatal.

To address this problem, the Team recommended implementation of a systematic measurement program for ventilation duct holdup and studies to determine how to avoid or minimize future buildup of materials in the ducts. In response to this recommendation, EG&G has initiated long-term and short-term plans to address the holdup problem.

The short-term plans include: 1) extensive measurements (called nondestructive assay) to identify ventilation ducts containing unacceptable levels of fissile material; 2) establishment a group to develop options and plans for recovery of those ventilation systems containing unacceptable amounts of buildup; and 3) construction of a mockup of the glovebox ventilation system to facilitate characterization of the materials in the ducts, test methods of removal, conduct training for inspection and removal teams, and test new filter system designs. The Team finds these short-term plans to be adequate.

The long-term plans include: 1) a comprehensive program to systematically monitor all locations in the plant where material holdup can occur; and 2) implementation of design changes to upgrade gloveboxes and associated plant systems as needed to reduce the accumulation of plutonium in the ventilation ducts. The importance of the long-term plans was accentuated by a fiber-optic inspection of line 43C in Building 771, which was made by EG&G during the team's visit. The extent of holdup in that line was greater than expected. Certain areas of line 43C had irregular formations of holdup material and at least one associated glovebox ventilation duct appeared to be blocked. These new findings strongly support the need to significantly upgrade the prefilters in the glovebox exhaust systems and document the design basis of the various ventilation and support systems. In order for such upgrades to meet industry standards, it will be necessary not only to reestablish the detailed design basis of various systems, but also to identify and complete structural upgrades and establish a formal configuration management program. The Team considers the EG&G methodology and approach being taken to these ends to be appropriate. However, a significant, continuing effort to complete these long-term actions will be required over the next five years.

Material Limits for Waste-line Piping and Ventilation Ducts

A calculation in the Criticality Safety Assessment Report dated July to September 1989, showed an unsafe condition of 5 kg of plutonium in an 8-inch pipe under worst-case conditions. The reason the calculation was included in the report was to demonstrate to Rockwell personnel that an 8-inch pipe containing plutonium could be unsafe. Rockwell managers told the Team they only considered computer calculations to be pertinent and that the computer calculations showed no problems. The Team reviewed the computer results and learned that the calculations assumed minimum external reflectors (such as water or human bodies). The Team performed its calculation with the same pipe size and material assumptions used in the computer calculation done by Rockwell, except for the reflection assumption. The Team's results showed that the condition in line 43C in Building 771 could be unsafe under some circumstances. This condition was included in the Team's report to illustrate to Rockwell that, although the risk was small, it was not a good practice to allow plutonium to accumulate in an uncontrolled manner in pipes of 8-inch diameter or larger.

Many nuclear poison and dilution materials may be present in ventilation ducts and, if present, will reduce the risk of an accidental criticality. In fact, subsequent to the Team's report, Rockwell performed chemical analysis of samples from line 43C. This analysis showed the presence of such materials and reduced the concern that an unsafe condition might exist in line 43C. The fact remains, however, that a significant collection of material has been observed in line 43C that was previously unknown.

EG&G has developed a new approach for detecting and safely dealing with the accumulation of plutonium in ventilation ducts or waste lines. This approach has the appropriate emphasis on safety and is a simple but scientifically valid manner of addressing the fundamental concern for the potential accumulation of unknown quantities of plutonium in the ventilation ducts. The method developed by EG&G can be summarized as follows.

- Some 1500 feet of ventilation ducts and a waste line identified as being likely areas where significant amounts of plutonium may have accumulated in the past have been surveyed with state-of-the-art nondestructive assay methods.

- The amounts of plutonium measured in this manner will be multiplied by a factor of two to provide conservatively high estimates of the actual amounts of plutonium in the ducts or waste lines. EG&G expects the actual errors in measurements with the techniques now being used at the Rocky Flats Plant to be smaller than this factor of two.

- If the amount of plutonium estimated in this manner in any ventilation line or any waste line exceeds a screening criterion of 400 grams, a special safety evaluation will be made of that line to determine what further action may be necessary to assure that there is no risk of accidental criticality from the plutonium in that line. This is a safe limit because there are no circumstances under which 400 grams of plutonium, in any chemical form or geometry used at the Rocky Flats Plant, can achieve a critical mass.

- Any ventilation duct or waste line that exceeds the 400 gram-screening criterion described above will be investigated to gain additional information. Such investigation may include chemical analysis of representative samples of the material, fiber-optic visualization of the interior of the ventilation duct or waste line, assessment of the potential for flooding or redistribution of material, assessment of the strength of the duct or line, and additional nondestructive measurements.

- A written safety evaluation shall be performed for any duct or line that exceeds the screening criterion. The safety evaluation shall be reviewed by the EG&G Rocky Flats' Independent Safety Review Committee and submitted to DOE within 30 days of discovering a condition that exceeds the screening criterion. If the written safety evaluation does not justify continued operation, activities associated with the particular duct or line shall be terminated, and remedial actions shall be undertaken.

- Safety evaluations are to be performed for ventilation ducts that are currently known to exceed the screening criterion. These ducts shall be evaluated prior to resumption of operations in which they are involved.

- Remedial actions on a particular duct or line are to be taken if any of the following criterion is satisfied:

    - the estimated multiplication ratio (K_{eff}) for the particular chemical form of the material, plus a four sigma uncertainty allowance, exceeds 0.94;

    - the radiation exposure rate for workers in locations with possible continuous occupancy exceeds 0.4 mrem per hour;

    - the estimated exposure to the general public in the event of an accidental release of the material would exceed limits established in DOE Orders;

    - the condition of the duct or line hinders the safe and efficient performance of the process line.

Remedial actions may include additional monitoring, removal of material from the duct or line, shielding of the duct or line, or replacement of the duct or line. Future surveillance of any duct or line that has required remedial action shall be designed to accommodate or compensate for that remedial action.

A program of nondestructive assay of the remaining ventilation ducts associated with plutonium operations at the Rocky Flats Plant is being undertaken. The process described above will be followed any time the screening criterion of 400 grams is exceeded.

The nondestructive assay program for the remaining ventilation ducts includes an option to conduct a statistical sample of the ducts rather than a complete survey. The technical justification for such an option rests, in part, on the outcome of the sample. Since a statistical sample has not been conducted, the Team cannot conclude whether or not this option is appropriate. If the sampling option is used, the Team recommends that DOE carefully review the outcome of the statistical sample before concluding that it is adequate. With this one exception, the Team concludes that the overall approach for detecting and controlling plutonium holdup in the ventilation ducts and waste lines is acceptable.

Nuclear Material Safety Limits

Two previous recommendations made by the Criticality Safety Assessment Team addressed nuclear material safety limits. These recommendations were based on a review of more than 600 criticality-safety infractions that occurred in the past. A root cause analysis of 214 of the most recent infractions (beginning in 1983) showed that many could be attributed to uncertainty by workers over which nuclear material safety limit applied in a particular situation. For example, adjacent gloveboxes containing the same material may have different material limits since different operations are conducted in the gloveboxes. There were also different limits on container size applied to adjacent operations. In a number of cases, material limits were exceeded as a result of filling a 4-liter container when only a 2-liter container was allowed to be filled. As a result, criticality-safety infractions occurred because the operators did not understand or did not remember which nuclear material safety limit applied in a given circumstance.

The Team recommended that: 1) a comprehensive review of criticality limits be made on a plant-wide basis, with a view toward the human factors of these limits (e.g., consolidation and simplification) so that the number of future mistakes attributable to different limits for each task could be reduced; and 2) a comprehensive review be undertaken to validate the size of containers needed for each work station and to limit the number of sizes for simplicity and safety.

The long-term actions proposed by EG&G were found to be satisfactory. These long-term actions involve the application of human factors engineering principles to simplify the nuclear material safety limits and the uses of containers. However, the short-term actions were essentially omitted because of the concern that a dramatic change could increase the potential for operator confusion. Therefore, the use of an independent criticality safety consultant to review nuclear material safety limit simplification programs and to develop a proper implementation strategy was proposed. The Team judged this short-term response to be unacceptable and recommended that a walk-through of each operations procedure be conducted to ensure that: 1) the procedures and nuclear material safety limits are consistent; 2) the limits are simplified to avoid operator confusion; and 3) human factors "traps" are identified and eliminated prior to resumption of the operation of a particular process line.

The Action Plan has been modified to respond to this short-term deficiency; the Team considers the May 16 version of the Action Plan to be acceptable in this regard. However, the Team is concerned that timely implementation of these short-term measures to support resumption of operations may be difficult to achieve unless management attention and adequate resources are expeditiously applied.

Safety Analyses

During its 1989 visit to the Rocky Flats Plant, the Team concluded that corrective actions needed to be taken in the area of safety analyses in general, and criticality safety analyses in particular. In many cases, safety analyses were neither comprehensive nor formal. The supporting documentation was sometimes inadequate, assumptions were not always clearly stated, and the analyses were not subject to peer review. Also, the safety analyses were usually not used to define a safe operating envelope for the plant, nor were they used on a continuing basis to search for and deal with unreviewed safety questions. In response to the Team's recommendation regarding safety analyses, EG&G has developed a safety analysis improvement program which is described in the "Rocky Flats Operational Improvement Plan," Section 4.2. The Team judged that the content, schedules, and milestones of the plan are sufficient to address the general inadequacy of safety analyses.

However, as part of its recommendation in September 1989, the Team also suggested that the analysis group responsible for performing Safety Analyses and Risk Analyses interact with those groups responsible for day-to-day operations in order to obtain maximum benefits from these analyses. The EG&G Action Plan indicates that the Rocky Flats personnel responsible for these analyses will seek input from operations personnel as further analyses are performed. However, the Team's discussions with the analysis group during the most recent visit indicated that participation by operations personnel is still likely to be superficial.

The analysis group does not appear to recognize that significant participation by operations personnel is essential in order to develop a thorough understanding and accurate description of the operation being analyzed. Furthermore, operational limits derived from the analyses will not be put into practice by operations personnel unless they can understand and appreciate them.

The Team recommends that management insist on a closer working relationship between these two groups.

Temporary Storage of Drums Containing Residue

The Team previously recommended that corrective actions be taken regarding the temporary storage of drums that contained residue from plant operations. One of the recommended corrective actions concerned the criticality potential that might be created by an earthquake at the plant. For example, adequate seismic restraints did not exist for drums stored in a vertical array in Building 371. There is a concern that these drums could fall into a critical configuration during an earthquake. Another recommended corrective action was that the Criticality Engineering group implement a program to verify the validity of all posted criticality limits, including the validity of the uncertainty factors for the material loadings, for these drums.

In response to the first recommendation, EG&G will install seismic restraints for the stored drums in Building 371. These restraints are scheduled to be installed prior to resumption of operations. In response to the second recommendation, EG&G is implementing a comprehensive plan for assembling systematic documentation of criticality analyses and posted criticality limits for the drums. The Team judged that both responses from EG&G are satisfactory.

DOE ISSUES

Several of the recommendations made by the Criticality Safety Assessment Team in September 1989 were directed toward DOE. The Team evaluated DOE's responses to these recommendations as part of its review. Although the Team has judged the DOE "Planned Actions" to be adequate, the Team notes that DOE has not taken significant action up to this point to resolve the issues under its purview. The Team believes that these recommendations are important to resolving some of the safety issues at the Rocky Flats Plant and, therefore, they should receive a level of attention by DOE management consistent with the attention EG&G is giving to the other recommendations made by the Team. Two fundamental issues associated with the recommendations are funding and security clearances.

Funding

Of particular concern to the Team are those long-term, major-upgrade projects requiring significant changes in levels of funding. These include: 1) funding drum storage and structural upgrades for seismic resistance in the Site Development Plan; 2) completing a comprehensive design basis study, with associated implementation of upgrades identified during the study; and 3) building a new criticality measurements laboratory for plutonium solutions.

Of the three items listed, the Team considers the first two to be necessary to achieve a level of safety at the Rocky Flats Plant more consistent with the highest industry standards. Since these first two items involve significant technical effort spanning several years, DOE should take steps to ensure funding. The third project, the criticality measurements laboratory, should be considered as part of DOE's long-term plans for the Rocky Flats Plant in the context of the rest of the DOE Nuclear Weapons Complex.

Security Clearances for Criticality Engineering Organization

The Team has determined that the ability of plant managers to improve the Rocky Flats Plant criticality safety program is closely related to recruiting, training, and retaining personnel in the Criticality Engineering group. The Team notes that, of all engineering personnel at the plant, the criticality engineers require the most frequent access to the widest range of classified information, and the criticality engineers cannot be productive if they must be escorted around the plant while awaiting a clearance. The Team estimates that DOE will have to expedite the clearance process to less than three months for at least the current number of people (about four) awaiting clearances in order to break the ongoing cycle of inadequacy in criticality engineering staffing.

Senator EXON. I would like to advise you, Mr. Secretary, that it is customary, as you know, that when we hold hearings, written testimony is to be sent up in advance. That was not done in this case. I would simply tell you that earlier this week I canceled a meeting with representatives of the Defense Department on another very important matter simply because they did not give us the information and written statements that they are required to do in advance. I did not exercise that prerogative in this instance. But I would hope that, in the future, you and the other individuals from the Department of Energy would follow those procedures so that we could have your advance testimony ahead of time. In any event, let's move on.

TRIDENT II W-88 WARHEAD

I want to go right to a very topical matter today. The first question I want to ask you is with respect to the Trident II W-88 warhead. Are you satisfied that this weapon is adequately safe in its current configuration or is there reason to reconsider the current warhead design, which I understand does not contain insensitive high explosives? What recommendation do you have in this area?

Mr. **Tuck**. I am satisfied that the deployed W–88 Trident II warhead is a safe weapon. It has been looked at by the Department, by the laboratories, and by other independent external oversight entities to answer the exact question that you are raising. It has been found and is still found today to be a safe weapon and properly and safely deployed.

However, having said that, as I mentioned in my statement earlier, the Department of Energy and the laboratories—which have significant responsibilities in this area—are constantly in the process of reviewing earlier decisions to ensure with later and newer technologies that the weapons that are in the stockpile are safe and are kept safe. This is to say that technological advances occur over time and tools are made available to those who are experts in this area to give them a better picture, over time, regarding the status of these weapons and their safety. As those developments are made, we have programs, as I alluded to in my statement, that seek to incorporate these new safety features or those features that make these nuclear weapons more safe.

Senator **Exon**. Then it is fair to say that it is your view and the position of the Department that the W–88 warhead is entirely safe but you are always keeping the option and the door open for further improvements in the safety area?

Mr. **Tuck**. That's correct. That is precisely the position of the Department. It does meet all current nuclear explosive weapon system safety standards.

8-INCH ARTILLERY SHELL

Senator **Exon**. Let me direct your attention to the nuclear safety article that appeared in the Washington Post this morning that discussed the various number of weapon systems. Let me begin first with the 8-inch artillery shell. Are you satisfied with both the current safety of the 8-inch artillery shell, as modified, and with the speed with which those safety actions were implemented once it became known that there was a potential problem?

Mr. **Tuck**. The answer to the first portion of your question is yes, the Department is satisfied that they are completely safe. The answer to the second portion of your question, having to do with the speed with which the Department took action, is, frankly, that that happened before our watch.

Senator **Exon**. February 1989, I believe.

Mr. **Tuck**. Before the current team was installed at the Department. I am not completely familiar with the timeframe from which it became clear that there could be a safety problem to the timeframe in which the problem was addressed. But I really would caution that we not speak at length in open session with regard to matters of this sensitivity and classification. I think that we could address them more completely and in more detailed fashion in closed session, subsequent to this, if that is the preference of the committee.

Senator **Exon**. Well, I would just say, Mr. Secretary, that the cat is out of the bag. I think that the public is entitled to know.

This Senator knew in February 1989. It was then a very highly sensitive matter. I tried to lead you into a situation where you could say the Department did act with great haste. I think they did. I don't think I am revealing any classified information in that there were some of us who were advised of this that had particular responsibilities. We followed it very aggressively. Teams were sent to wherever these shells were overseas, and some in the United States. They took care of the ones overseas first and then came back to the United States. I think the Department moved with great dispatch on this matter. In fact, as far as I can tell, I think it was one of those model programs where the Department of Energy moved with great speed and efficiency once a potential—and I emphasize the word "potential"—problem existed.

Mr. TUCK. The system did work.

SRAM-A WARHEAD

Senator EXON. I simply say that for the record.

Mr. TUCK. The system did work. You are absolutely right. Thank you for underscoring that.

Senator EXON. Let me follow on with some other questions that we went into in a previous meeting this morning with some of our most distinguished scientists in our nuclear weapons laboratory with regard to the SRAM-A warhead. Now, we all recognize that the SRAM-A system is nearing the end of its useful life. That is why we are talking about a follow-on system where standards for safety and efficiency would be improved. One solution on the horizon in that regard is the SRAM II and its new warhead, both of which are developments that I think we can be justly proud of.

At the hearing this morning, three Department of Energy weapons laboratory directors were unanimous in urging the committee to review whether, given the decreased tensions around the world, we would take the SRAM-A weapons off of alert B-52s and put them in some kind of acceptable storage, where they would be available if we would have an unexplained emergency of some kind that would raise up tensions. What do you feel should be done in this area, Mr. Secretary? We would very much appreciate your candid view on this issue because it is now well known to the members of this committee that, once again, there are, and I use the word "possible," concerns as to the safety of the SRAM-A. Do you think it should be removed from our alert B-52s at this stage?

Mr. TUCK. Let me answer in this fashion, Senator Exon. As you are aware, the Energy Department and the Defense Department have been looking at the SRAM-A issue for some time. The Defense Department has taken actions with the way it conducts its operations with regard to the SRAM-A on aircraft. The Defense Department is continuing that review at present, and we are involved with the Defense Department in yet another review, the results of which I expect in the very near-term, like in June.

I appreciate the lab directors' observations. I think that they should definitely be made a part of that review that is ongoing at present. I think that all factors should be considered, and I think that the system is structured in such a fashion to permit that decision—that is to say, to take it off alert—in the very near timeframe, if that is what all who view it recommend to the Secretaries, or if that is what the consensus is.

Frankly, personally, my own view is that this is the direction in which we are going. But there is a process that I think should also be kept intact, and that is that groups that are established and charged with this specific responsibility should have the opportunity to complete their assignment and to make their recommendations and to have the recommendations reviewed, peer reviewed, before we act precipitously. I think that process is working. I think that process will probably—and this is conjecture on my part—result in what you are talking about in the very near timeframe.

Senator EXON. But you have no opinion on this pending the outcome of those considerations?

Mr. TUCK. I think those considerations should be complete. I think that they are ongoing and I think they are near completion. But I think that the regular order ought to prevail and that the decision-makers ought to be afforded, in a structured process, an opportunity to review input from experts in this area and not proceed precipitously.

Senator EXON. Thank you, Mr. Secretary. We, on the committee, will be taking a very detailed, critical view, and urge all speed in making the proper decision. My time is up. Senator Thurmond.

NEW PRODUCTION REACTOR

Senator THURMOND. Thank you very much, Mr. Chairman. Mr. Secretary, the fiscal year 1991 request calls for $363 million for the New Production Reactor. What will this amount fund and what is the total funding projection for the NPR?

Mr. TUCK. What this amount will fund in 1991 are additional architectural engineering actions, leading to a record of decision that will be made in the fall of 1991 or winter of 1991, which will define how we will next proceed. But, to give you specifics of how the $360-some-odd million that we have in the 1991 budget is prepared to be deployed, I would like to ask, with your permission, Dom Monetta, of our staff, to come forward and answer in greater detail.

Mr. MONETTA. Senator, the program, as it is presently laid out, is to move expeditiously through fiscal year 1991 with preliminary design, confirmatory development, and the environmental impact statement that will allow us to bring all of these various studies, designs, and statements to bear on a record of decision, which is nominally set for December of 1991. This will allow us to be able to present to the Secretary a complete series of alternatives, properly costed-out, that will look at the available options that are under study with the EIS and the preferential designs that are moving forward now into preliminary design—Title I, as we call it—and allow him to make, with his advisers, the decision as to which approach we take after that point in time. So that is the way the 1991 budget is laid out.

Senator THURMOND. Did you answer what the total funding project for NPR is?

Mr. MONETTA. The total program funding in current dollars, as it is presently laid out up to the year 2000, is just a little under $11 billion.

Senator THURMOND. It's $11 billion.

Mr. MONETTA. Yes, sir.

COMPLEX 21

Senator THURMOND. Secretary Tuck, the Department's modernization plan calls for the Complex 21 to be in operation about 2015. Does the Department have an estimate of what this complex will cost? Is any of the fiscal year 1991 request associated with this endeavor?

Mr. TUCK. Some portion of the fiscal year 1991 budget request is associated with what Complex 21 will look like in the year 2015. But, nominally, not a great deal of money, approximately $400 million, is the sum that comes to mind. The total cost of what Complex 21 will look like is, frankly, not knowable at this point and will not be known until the record of decision with regard to the modernization plan is complete, sometime in fiscal year 1994.

The Secretary will be presented with a series of options. Those options range from modernize in place to the extreme of going super-site at some point in the future. Depending on which option or somewhere in between the Secretary decides and the record of decision supports will dictate what the dollars are that will be attendant to designing, completing, and having operational Complex 21 by the year 2015.

For example, if we go to a super site, I anticipate that the cost, frankly, will be larger than if we go to a "modernize-in-place" mode of operation. But those costs I don't think are knowable until that record of decision, and I think that record of decision will not be before fiscal year 1994.

OFFICE OF ENVIRONMENTAL RESTORATION AND WASTE MANAGEMENT

Senator THURMOND. Mr. Secretary, I applaud your initiative in establishing a separate appropriations account to fund Department of Energy cleanup. It should ensure that the money for environmental cleanup is used only for the purpose for which it is intended. Does the Department have the necessary management tools in place to manage this account? If so, how will it be administered?

Mr. TUCK. The Department has structured an Office of Environmental Restoration and Waste Management. It has excised functions in dollars from Defense Programs and from non-defense programs into this Office of Environmental Restoration and Waste Management, which is headed by my associate, Leo Duffy.

We have segregated budgets, dedicated budgets, established structures within the Department, particularly in the field, that will serve to support the kinds of initiatives that you are describing, in terms of our effort to try to make sure that dollars for Environmental Restoration and Waste Management are not raided by others who are on the production side, seeking to spend monies in different fashions; in other words, to hold harmless identified Environmental Restoration and Waste Management funds.

Mr. Duffy is with me today. If you will permit, I would like to ask him if he can identify further management arrangements that we have made within the Department in support of the overall goal.

Mr. **Duffy**. Senator, we have established at each field office a similar organization to the Department's Environmental Restoration and Waste Management group at headquarters. We have an assistant manager who is responsible for the Environmental Restoration and Waste Management program at each of our field offices, and they are in control of the budget for the environmental restoration operation. At the present time, I don't believe we have the full infrastructure in place. This is one of the reasons why we are watching very closely the amount of money that we are extending out for environmental restoration. The waste management operation is a continuing operation. We believe we have significant capability in that area and we don't see a problem.

In corrective action, I think if you look at the first 13 "Tiger Team" evaluations, we identified a shortfall in environmentally-trained personnel in the RCRA, TSCA, and other act areas, and we are looking at bringing personnel into that area. In some of our key areas, like Fernald, we have brought in 12 additional people to the Department of Energy office in Fernald to guide the program.

So we are moving along. We are not there. We don't expect to be there until 1992, with a full complement, about 350 people at headquarters and about 750 people in the field.

Senator **Exon**. Senator Thurmond's time is up, but he has asked for an additional 2 minutes. He has another meeting that he has to go to and cannot stay. Without objection, we will yield him 2 additional minutes.

SOVEREIGN IMMUNITY

Senator **Thurmond**. Thank you very much, Mr. Chairman. Mr. Secretary, you may be aware that both the House and the Senate are considering proposed legislation that would waive the sovereign immunity of your Department with regard to compliance in a portion of environmental requirements at Department of Energy sites. What impact will such a law have on the Department and those who operate the sites? What impact will it have on cleanup, restoration, and modernization priorities at Department of Energy sites?

Mr. **Tuck**. That is a very important question. Our counsel, the General Counsel of the Department, is here. I would like to ask that he answer that question for you.

Senator **Exon**. This is Mr. Wakefield, for the record.

Mr. **Wakefield**. Yes. I am Stephen Wakefield, General Counsel of the Department of Energy.

Senator Thurmond, these bills do not affect the responsibility that the Department has to comply with all environmental laws. We already have that responsibility. What these bills would do is to waive sovereign immunity so that the States administratively could assess fines and penalties directly against the Federal Government, the Department of Energy in this case, the Department of Defense, and others.

The difficulty that we perceive with the legislation, as it passed the House, and as it is now pending before the Senate in S. 1140, is that it would permit the States to come in, even though we are attempting to clean up, and, through the leverage of assessing fines and penalties, change our priorities, so that rather than cleaning up the worst situation initially, we might be in a position of having to clean up those sites in States that have the most aggressive attorney general. So, from that standpoint, we think it would interfere with the orderly process of cleanup.

AVAILABILITY OF QUALIFIED TECHNICAL PERSONNEL

Senator **Thurmond**. Thank you. Secretary Tuck, in previous hearings on environmental matters, we have been advised as to the various departments competing for a limited number of qualified technical personnel. Does the Department have sufficient qualified technical personnel and contractors to adequately administer the number of environmental projects expected to be funded in fiscal year 1991?

Mr. **Tuck**. As it relates specifically to fiscal year 1991, it is to be determined. But, in general, the question that you raise, whether or not we have the competent technical talent available to us, the answer, in short, is no. That is why we are urging and asking for the support of Congress to permit us to have what we call "critical position designation authority," or to have some central authority within the executive branch to have that authority, so that we can attract the kind of technical talent that is out there to work for a super Government salary, in effect capped probably at a Cabinet Officer's level, but to attract them, by being able to pay them what they are worth in the private sector, to an interesting and challenging position within the Government.

Similarly, we believe that if we could have a waiver of the prohibition on double dipping for retired civilian and military personnel we could also attract the kind of talent that we require to affect competent oversight of our contractors to a greater degree to come to the Department.

ENVIRONMENTAL COMPLIANCE IN OLDER FACILITIES

Senator **Thurmond**. I have one last question and will then have to leave after that. Secretary Tuck, can the Department of Energy comply with all environmental laws in the existing older facilities, or do we need new ones?

Mr. **Tuck**. Well, our policy is to get into compliance with those laws. It is to be determined whether or not sufficient numbers of resources will be dedicated to that task. We are in this together.

Senator **Thurmond**. Thank you very much.

Mr. **Tuck**. Thank you, Senator Thurmond.

Senator **Thurmond**. Thank you, Mr. Chairman.

Senator **Exon**. Thank you, Senator Thurmond. Senator Bingaman.

REDUCTIONS IN WEAPONS RESEARCH, DEVELOPMENT, AND TESTING

Senator **Bingaman**. Thank you, Mr. Chairman. Mr. Tuck, let me ask a question that came up in our hearing this morning. We had some of the directors of the Department of Energy laboratories before us. Dr. Nuckolls spoke from the Lawrence Livermore Lab. He said in his testimony—and this is a quote—"since 1985 the Livermore Laboratory has lost nearly 25 percent of its uniquely trained and skilled WRD&T personnel. The loss of personnel is projected to continue in fiscal year 1991. The DOE Research and Technology Development Program is substantially under-funded." Is that your position as well?

Mr. **Tuck**. It is true that the dollars that have gone into weapons research, development, and testing have gradually declined over that period that you mentioned. It is true that the role of the laboratories has been in areas other than just weapons research, development, and testing over that period. I am not certain that it is only the reduction in weapons research, development, and testing dollars from the Department of Energy that is the direct and contributing factor that drives what the employment ceilings are at the laboratories. I rather suspect that it is not the only factor involved.

Having said all of that, I think it is extraordinarily important for this Nation to maintain the competence, the talent of these laboratories at a level approximately the same as it is today, I believe personally—it is not the Department's position—and that we should find the means to make sure that we can fund an infrastructure of approximately 24,000 scientists at these weapons research and development laboratories and dedicate the resources to make sure that we can keep them there and keep them in the position of providing the guts of the Nation's nuclear deterrent. Their brain-power is our Nation's nuclear deterrent, period. It is that important.

FUNDING LEVEL ON VERIFICATION AND CONTROL TECHNOLOGY

Senator **Bingaman**. Let me ask about the funding level on verification and control technology. In your testimony you indicate that the $174 million request provides an increase of $8.2 million for the fiscal year 1991 effort. This morning Dr. Nuckolls said in his testimony that the current level of support has not kept pace with the technology requirements identified as needed in today's negotiations. Yet the proposed 1991 operating budget has declined from 1990 levels. So I guess those two statements are consistent if a lot of yours is going to construction and he is talking about the operating budget. Is that the situation?

Mr. **Tuck**. I don't know specifically what Dr. Nuckolls is talking about, but, in general, he is correct. We do not have sufficient dollars for the verification elements that we will require. We purposefully did not fund them or did not request them, not knowing what the outcome of current negotiations would be. I think that we have in small footnotes indicated to the committee that we may be back and that we may require additional dollars to support these verification technologies.

Senator **Bingaman**. Would you expect to know in time so that we could consider that when we mark up legislation or do appropriations bills?

Mr. **Tuck**. I will make every effort to make sure, and we should know a lot more after next week. We should know a lot more, and I hope, if your markup is roughly mid-June, that we can guide you or help you or assist you in that regard.

Senator **Bingaman**. As I understand it, your expectation is that you will need additional funds above what has been requested in the budget that was sent to Congress for this verification activity.

Mr. **Tuck**. We may require additional moneys, yes, sir.

WEAPONS SAFETY ISSUES

Senator **Bingaman**. I gather you answered a couple of questions that Senator Exon asked regarding safety issues. Let me just ask, as a general matter, if you perceive that there is a significant backlog of unmet safety requirements that exist with regard to our weapons stockpile that the Department of Energy needs to address?

Mr. **Tuck**. No, sir. I do not perceive that there is a significant backlog of significant safety issues that the Department needs to address. I do, however, believe that the necessary dollars should go into the weapons research, development, and testing account to ensure that we can continue testing to ascertain the safety quotient, for want of a better description, of our stockpile.

I do believe that the programs that are in place should be funded adequately, so that we can be continually updated on whether or not we have a safety problem with one of our weapon systems. But I am not aware from the lab directors or other technical experts within the Department of any significant backlog of weapons safety issues.

The newspaper does not speak to a significant number of weapon systems. I think it addressed only three this morning. We, in the Department, don't happen to agree with all of the conclusions that were in the newspaper.

Senator **Bingaman**. One of the points that was made this morning in testimony was that the issue of whether a particular weapon is safe is not an absolute determination. It is relative, and it is determined on the basis of a balancing of what is required to increase the safety factor, versus what is lost in terms of military capability. Since it is a balance type judgment like that, it has to be reassessed. In light of the changed threat and the lessened tension between ourselves and the Soviets, in particular, do you think it is appropriate that we be reviewing the appropriate level of safety that is required in these weapons that are in the stockpile?

Mr. **Tuck**. I think that the programs and process that are in place today do precisely that. I think that those reviews are necessary, they are ongoing, and I think they will produce the kind of result that we all would like, and that is increasing the margin of safety, wherever possible, with regard to nuclear weapons.

Senator **Bingaman**. That is all I have, Mr. Chairman. Thank you.

Senator **Exon**. Thank you very much, Senator Bingaman. We have two other members of the committee that are here this afternoon and I am very pleased to have both of them here. Senator Levin is a member of the subcommittee and Senator Wirth is not. Senator Levin, you would be next, because you are a member of the subcommittee, although Senator Wirth was here ahead of you. However, you would take precedence because of your membership.

Senator **Levin**. Thank you, but I would be happy to defer to Senator Wirth.

Senator Exon. Senator Wirth, we are glad to have you here.

SAFETY OF THE W-88

Senator Wirth. Thank you, and thank you very much, Senator Levin. Secretary Tuck, you know of my concerns related to Rocky Flats and the speed with which you all are apparently moving to reopen Rocky Flats.

First of all, Mr. Chairman, I would like to ask that Jeff Smith's article, which appeared this morning in the Washington Post, be included in full in the record.

Senator Exon. Without objection, it will be included in the record.

[The information follows:]

WASHINGTON POST

WEDNESDAY, MAY 23, 1990 P. A-1

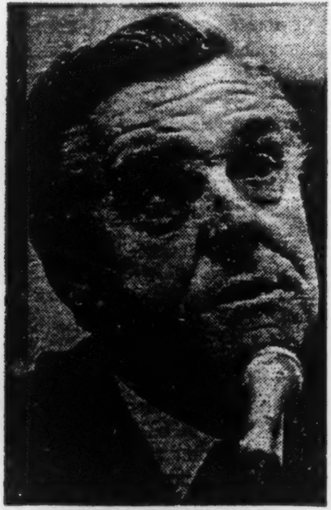
Defective Nuclear Shells Raise Safety Concerns

U.S. Secretly Repairing Weapons in Europe

By R. Jeffrey Smith
Washington Post Staff Writer

In a series of secret moves, the U.S. government discovered—and is repairing—defective nuclear artillery shells that could have exploded accidentally while stored in Europe, and has started urgent studies of the designs of two other atomic warheads whose safety is suspect, according to senior U.S. officials and weapons scientists.

In the most serious incident, the government in 1988 belatedly discovered a defect in the W-79 short-range artillery shell after it had been deployed in Europe. Urgent orders were issued not to move the warheads, and repair teams hurried to the nuclear ammunition depots to disable the several hundred shells so they could not be accidentally detonated, the officials and scientists said.



JAMES D. WATKINS
. . . orders special scientific inquiries

The artillery shells, which are deployed in at least three West European countries and in U.S. stockpiles, are being modified so they will detonate only after being fired in battle, the officials said.

The Joint Chiefs of Staff, in a separate nuclear weapons safety incident, last year secretly imposed special restrictions on the handling and deployment of a short-range missile carried by U.S. strategic aircraft in order to avoid accidental explosions that could disperse cancer-causing, radioactive plutonium from the missile warhead, these sources said.

The Department of Energy, in a third case, last week agreed to a secret congressional request for an independent scientific inquiry into the possibility that a nuclear warhead now being deployed aboard Trident strategic submarines could be detonated in a possible missile-handling accident in port, according to the sources.

The problems with the three weapons have raised serious questions on Capitol Hill and in the Bush administration about U.S. nuclear weapons safety. Some experts forecast that additional problems may be uncovered by special scientific inquiries at the nuclear weapons laboratories ordered recently by Secretary of Energy James D. Watkins.

The Department of Energy (DOE) is responsible for the design and production of all nuclear warheads. The Department of Defense (DOD) determines warhead requirements and develops the weap-

See WEAPONS, A18, Col. 1

WEAPONS, From A1

ons on which the warheads are deployed.

Watkins, while declining to discuss difficulties with specific weapons, said in an interview this week that "we're not all that comfortable" with the government's past approach to several safety issues, and that "we need to focus a lot more" on measures to diminish the risk of accidentally dispersing plutonium in warheads.

Watkins also emphasized that when weapons safety problems are uncovered, "we take the operational steps necessary to minimize those risks, take the weapons out of service if necessary and then look for some mid-term and long-term fixes. We're in that process right now."

He added in response to questions that "fortunately, we don't have many [weapons] that fall into that category, but I can tell you that we're serious about those things and we do what's necessary to make sure that we don't have any situation . . . where we can't meet our [safety] specifications."

In contrast to the wide attention recently given to environmental and scientific problems of nuclear weapons production, safety questions about individual weapons have scarcely been scrutinized outside the tight-knit community of weapons designers and the defense officials to whom they answer.

Some high-level Bush administration officials say they believe that safety issues traditionally have had a much lower priority than military concerns such as increasing a nuclear weapon's explosive power, efficiency or reliability.

But Watkins, who says he came into office in 1989 with a "very significant sense of laxity in the safety practices of DOE," has ordered what other officials say is the first comprehensive assessment of the probability of an accident involving any of the more than 20,000 nuclear warheads deployed with U.S. forces around the globe.

No nuclear weapon ever has been known to detonate accidentally and produce a nuclear yield. However, there have been unexpected detonations of the volatile chemical explosives surrounding the nuclear materials in warheads, including several incidents that resulted in considerable radioactive contamination.

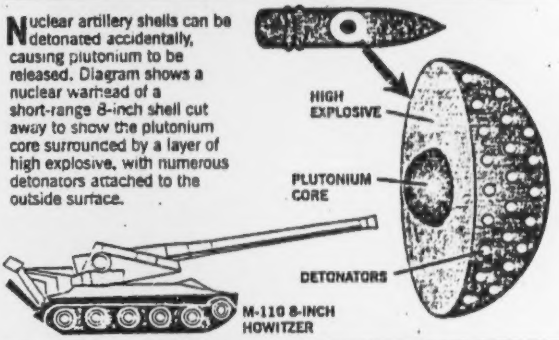
Officials say that Watkins's safety concern about the Short-Range Attack Missile-A, or SRAM-A, carried by strategic bombers led to establishment of a special committee on nuclear weapons safety last year that includes senior DOD and DOE officials.

Although it will report simultaneously to Watkins and Defense Secretary Richard B. Cheney, the two departments, in a conflict indicating diverging priorities on weapons issues, fought a heated battle over who would chair the committee. The dispute eventually was won by DOE.

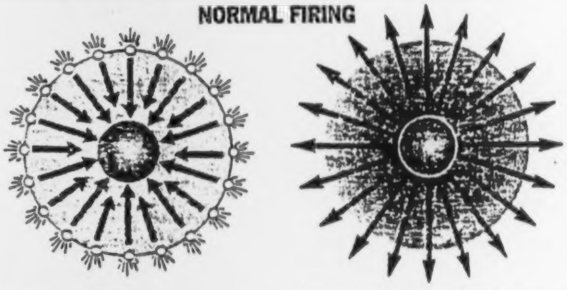
"I felt it was necessary that we have a somewhat independent committee . . . that could stand off from military requirements, mili-

ATOMIC ARTILLERY PROBLEMS

Nuclear artillery shells can be detonated accidentally, causing plutonium to be released. Diagram shows a nuclear warhead of a short-range 8-inch shell cut away to show the plutonium core surrounded by a layer of high explosive, with numerous detonators attached to the outside surface.



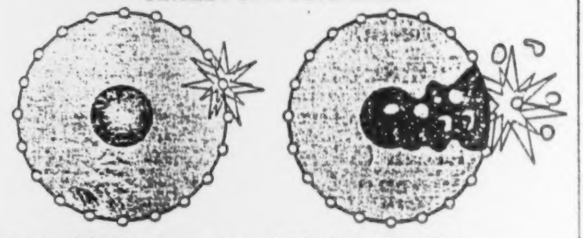
NORMAL FIRING



When all detonators fire simultaneously, the inward-traveling detonating wave uniformly compresses the core of plutonium.

With its high density, the plutonium core becomes supercritical, releasing huge amounts of energy from the nuclear chain reaction.

SINGLE-POINT DETONATION



When a single detonator is fired by accident, or if the high explosive is accidentally ignited at a single point on the surface by some other means, the detonating wave expands outwardly from the single point.

Instead of the plutonium core being compressed uniformly, it is pushed out away from the center. Without significant compression there may be no full-scale nuclear explosion, but radioactive plutonium is released. If the explosion occurs while the shell is in its launch tube, the tube will reflect neutrons into the plutonium core, simulating deliberate compression and likely producing a significant nuclear explosion.

SOURCE: Natural Resources Defense Council; The Washington Post

BY JOHNSTONE QUINAN—THE WASHINGTON POST

tary demands and focus heavily on the safety issue," Watkins said. "I just felt that conflict of interest ought to be separated out."

The information about recent nuclear weapons safety problems in this article is derived from interviews with more than two dozen U.S. military and civilian officials and nuclear weapons scientists. None was willing to be quoted by name, because everything about the episodes is highly classified.

The W-79

Officials say the most dangerous and politically sensitive incident was the surprise discovery in early 1988 that W-79 artillery shells deployed in West Germany, Italy and the Netherlands could accidentally explode if they were struck forcefully at a sensitive spot, perhaps by a stray bullet or impact from a nearby battlefield explosion in wartime.

A single, elliptical reference to the problem appeared in an unclassified report issued by Watkins three months ago. The report mentioned that a warhead developed by Lawrence Livermore National Laboratory under DOE supervision, identified only as "WXX," had recently caused "one-point safety concerns" that were confirmed by underground nuclear testing.

U.S. officials subsequently confirmed that the "WXX" was the W-79.

"Nobody was blase about it, but nobody was [illegible] either," said a senior military official of the government's reaction. "We did not foresee an imminent catastrophe. But when it comes to nuclear safety, we treat everything as potentially serious."

Computer calculations and underground tests before the start of production in 1981 had indicated no safety problems. But a new safety analysis at Livermore in 1988 raised concerns that were confirmed by secret underground nuclear tests in December 1988 and February 1989, officials said.

The tests indicated that the W-79 did not meet a secret government safety standard requiring that with any warhead design, under any circumstances, there be less than a one-in-a-million chance of an accidental nuclear explosion with a yield as powerful as a blast from about four pounds of TNT, enough to destroy a small room.

Several officials said an inadvertent explosion of the material surrounding the nuclear core was particularly likely to produce a nuclear yield if it occurred while the shells were loaded inside the 8-inch howitzers from which they are fired, an unusual circumstance in peacetime. But a senior military official said, "For a while, we were also worried that these things might go off if they fell off the back of a truck and landed in a certain way."

The officials did not say how big an accidental explosion a W-79 shell might have caused. The warhead is designed to explode in battle with up to a 10-kiloton nuclear yield, about two-thirds the force of the 1945 Hiroshima bomb.

A highly-placed foreign official said that after the confirming nuclear test, a small group in the West German government was told in a general way that "there was a chance of technical failure leading to an explosion" of the shells and that "some adjustments" to their design were needed to prevent any accident.

Senior West German officials "were not informed explicitly" how an accidental nuclear blast might occur, the official said. "But I do not rule out that a more detailed briefing was given to specialists" in the German ministry of defense, he added.

Officials said the information was kept otherwise secret to avoid panicking citizens or calling into question the viability of the U.S. nuclear force in Europe, which includes dozens of nuclear-tipped missiles, more than 1,000 nuclear bombs and hundreds of older, nuclear-tipped artillery shells.

"It was obviously a politically hot potato," a U.S. official said.

Another senior military official said the episode alarmed the Pentagon and induced tensions with DOE. "It was the sort of problem that never should have occurred," the official said. "There simply was no good excuse for it."

After ordering that all W-79 warheads be immobilized at their storage sites, the government sent teams of experts in early 1989 to install special "safing mechanisms" to block any detonation of the shells, several officials said.

Some of the warheads have been returned to the Pantex warhead production plant in Amarillo, Tex., so the "safing mechanisms" can be disabled and additional steel plating installed inside the skin of the shells at particularly sensitive spots.

Of the W-79 problem, Watkins said only, "Without any question, safety has been preserved." Pentagon spokesman Pete Williams said last night that "the point is: the weapon is safe." He added that "changes were made to the W-79, but I can't discuss the details of that."

The shells are in special U.S. storage bunkers overseas and at the Seneca Army weapons depot in New York state, including some that are still inoperative. Asked why, a senior official said, "it has to do with politics within the [Western] alliance."

But the Nuclear Weapons Council, three senior DOE and DOD officials who decide nuclear warhead production matters, was sufficiently concerned about the W-79 to decide early this year that its design would not be replicated in a slightly smaller artillery shell, the W-82.

"If one of these shells had a problem, then by definition the other one would certainly have it, too, in terms of the basic physics," one official said. "They basically have the same 'primary'," or nuclear core, he explained.

The decision forced at least a two-year suspension of W-82 production, which had been scheduled to begin last February. Several sources said the delay was partly at the urging of Congress, which voted secretly last year to block W-82 spending until the Bush administration certified that it was safe.

President Bush announced on May 3 that he wanted to halt the W-82 deployment program in response to the declining military threat in Eastern Europe. A senior U.S. military official said the design defects, which Bush did not mention, played no role in the decision.

W-88 Trident Warhead

Discovery of a safety defect in the W-79 artillery shell prompted a more extensive review by the weapons laboratories of other warheads, which soon cast a shadow over the thermonuclear weapon now being deployed atop D-5 missiles in Trident submarines, the W-88.

Some U.S. weapons scientists have alleged, based on computer modeling of accident scenarios, that the W-88 could be detonated accidentally if the propellant fuel in D-5 missiles catches fire as a result of mishandling during loading operations at the Trident bases in Bangor, Wash., and Kings Bay, Ga.

A powerful nuclear blast or widespread dispersal of cancer-causing plutonium dust would result, these scientists say. They add that, in years past, the latter possibility has been taken so seriously that Livermore experts prepared maps of potential plutonium fallout over Spokane, Wash., near the Trident base at Bangor.

The allegations are the subject of a bitter scientific dispute at the highest levels of the Pentagon and DOE, according to some of the officials involved. The stakes are enormous, because the Trident missile system is expected to be at the heart of America's strategic deterrent force for the next three decades.

Although senior DOE and DOD officials say the risks are small, Watkins last week agreed to a secret, bipartisan congressional request that the issue be adjudicated by a special panel of three independent scientists cleared to review the nation's most sensitive nuclear weapons information.

Watkins said, "I have viewed all of the analysis, time and time again" on the W-88, as have the directors of the three U.S. nuclear weapons laboratories, and "I'm satisfied . . . that we can continue to do the analysis we have to do on that weapon without undue concern." He said it now meets all nuclear explosive and weapons system safety standards.

At the same time, Watkins said that "had I been intimately involved in this process" during key deliberations in the early 1980s, "I would not have" made the decision to use the warhead's current design. "I don't think that kind of decision will ever be made again, and certainly won't be made while I'm here, and I believe with the kind of dicussions that we've had with DOD it's not going to be made again."

At issue is the use of volatile explosive materials in the W-88 warhead that scientists say would explode in a missile fire, producing forces that could compress the nuclear core in each bomb and begin a nuclear chain reaction. The Trident missile is considered particularly vulnerable to such an accident because its multiple warheads are arranged in a circle around the propellant fuel in the missile's third stage.

The warheads on most other U.S. ballistic missiles are arrayed on a platform that sits atop the final stage, allowing for the use of some form of insulating material to protect them from a missile fire.

Scientists at Livermore strongly protested the decision to use the volatile materials, but W-88 designers at Los Alamos National Laboratory said that using a less volatile material would not have substantially diminished the risk of an accident. The Navy also opposed the idea because the added weight of the alternate materials would have reduced the missiles' range or required the deployment of fewer warheads on each missile.

Watkins said he would have "accepted the very modest penalties" associated with using the less volatile material. He said "a special task team" has been formed to "see what can be done" about W-88 modifications.

The congressional request for an independent inquiry was initiated by Rep. John M. Spratt Jr. (D-S.C.), who chairs the House Armed Services Committee's panel on defense nuclear facilities. He was joined by Rep. Les Aspin (D-Wis.), the House Armed Services Committee chairman; Rep. William L. Dickinson (Ala.), the committee's senior Republican; and Rep. Jon L. Kyl (Ariz.), the senior Republican on the committee's defense nuclear facilities panel.

Details of the Trident safety problem described in this article were not obtained from congressional sources.

W-69 SRAM-A Warhead

Watkins said that in early 1989 he told senior aides to ask the directors of the nation's three nuclear weapons laboratories whether they were "satisfied" with the agency's handling of safety issues. "The answer was no," he said, and one lab director used the opportunity to raise strong concerns about a particular weapon that "needed to have some aggressive attention."

Watkins declined to say what the weapon was, but officials at another agency identified it as the SRAM-A, a 1970s-vintage weapon carrying a warhead that uses the same volatile material as the W-88 Trident warhead. Roughly 14 feet in length, the weapon can be slung below the wings of B-52, B-1B or FB-111 bombers or carried in the internal bomb bay. "It's basically a fuel tank with wings," one official said.

They said longstanding safety concerns about the weapon are partly based on an intense B-52 engine fire on the runway at Grand Forks, N.D., in September 1980 that injured a crewman and came close to causing an electrical short in the SRAM. The short might have caused the volatile material to explode, dispersing the plutonium in the weapon's core, several officials said.

Acting at Watkins's initiative, DOE officials sought to mention several safety problems involving the SRAM-A warhead in a routine report to Bush last year about the overall safety of the nuclear weap-

THE U.S. NUCLEAR ARSENAL

Warhead	Deployment mode	Explosive yield
Warheads With "Insensitive High Explosives"		
B-61	Tactical bomber weapon	10 to 345 kilotons
B-83	Strategic bomber weapon	up to 1,200 kilotons
W-85	Pershing II missile	0.3 to 80 kilotons
W-87	MX missile	300 kilotons
W-80	Air-Launched Cruise Missile and Sea-Launched Cruise Missile	5 to 150 kilotons
W-84	Ground-Launched Cruise Missile	170 kilotons
Warheads With "Normal" High Explosives		
W-33	8-inch artillery shell	1 to 12 kilotons
W-48	155mm artillery shell	less than 1 kiloton
W-79	8-inch artillery shell	0.5 to 10 kilotons
W-56	Minuteman II missile	1,200 kilotons
W-62	Minuteman III missile	170 kilotons
W-68	Poseidon submarine missile	50 kilotons
W-69	Short-Range Attack Missile	1,100 kilotons
W-70	Lance missile	1 to 100 kilotons
W-76	Trident C-4 missile	100 kilotons
W-78	Minuteman III missile	335 kilotons
W-88	Trident submarine missile	475 kilotons
B-28	Strategic and tactical bomber weapon	70 to 1,450 kilotons
B-43	Strategic and tactical bomber weapon	less than 1,000 KT
B-53	Strategic bomber weapon	9,000 kilotons
B-57	Tactical aircraft weapon	1 to 20 kilotons
B-61*	Strategic bomber weapon	10 to 500 kilotons

*Initial models

SOURCES: Natural Resources Defense Council, others ons stockpile. But DOD officials rebelled, causing submission of the report to the White House to be held up for more than three months, according to officials at both agencies.

Watkins said he used the dispute to win DOD's approval for a new weapons safety review committee under DOE's control. He also said the safety matters at issue were explained to Bush by national security adviser Brent Scowcroft with Cheney's concurrence.

"I would have just moved unilaterally [with Bush] had I not been satisfied that the thing was being well aired," Watkins said. Other officials said Watkins and Cheney agreed on the need to control aircraft operations involving the SRAM-A tightly while further analysis is being done.

DOD spokesman Williams said "the Joint Staff did approve modifications to procedures involving the SRAM-A," but declined to say what they were.

Senator **Wirth**. The article says, "some U.S. weapons scientists have alleged, based on computer modeling of accident scenarios, that the W-88, the Trident missile, could be detonated accidentally if the propellant, fuel, and D-5 missile catch fire as a result of mishandling. The latter possibility has been taken so seriously that Livermore experts prepared maps of potential plutonium fallout over Spokane, near the Trident base in Bangor."

One of the reasons that we have been told in Colorado that you were so eager to move on reopening Rocky Flats is that Rocky Flats is essential for national security reasons, for the purposes of manufacturing the triggers for the Trident missile.

Now, it would seem to me that if, in fact, what is in Mr. Smith's article is correct—and it has not been suggested that it is incorrect—then this, I would think, would take a good deal of pressure off of Rocky Flats for right now. While you are in the process of reviewing the W-88, you presumably would want to make sure that it is operating safely and correctly before you build more of them. Is that a logical conclusion for people living around the plant to come to?

Mr. **Tuck**. Yes, of course it is a logical conclusion. You want to build a safe weapon.

What is also in the article, which has not been rejected, is Admiral Watkins' statement that the W-88 meets all current nuclear explosive weapons system safety standards, and that it has been looked at by the lab directors, by other independent experts, and is being looked at by the Department on a continuing basis. That is the way we observe, see, or view the W-88 issue.

Now, having said all of that, we are not in the business of operating Rocky Flats one day sooner because we are driven by some production goal to get W-88s on D-5 missiles on submarines going to sea next year. We are in the business of operating Rocky Flats when Admiral Watkins is apprised, is confident, and is certain that it is safe to do so. We have taken advantage of this opportunity, while Rocky Flats has not been operating, while we have changed contractors, while we have upgraded the margin of safety, to ensure that, when Rocky Flats does normalize, that we have all the observations, all the comments, all the views of all the independent internal and external oversight bodies, their assessment of whether or not Admiral Watkins should conclude that it is safe to operate Rocky Flats. When all of that is done, Rocky Flats will normalize its operations and not before. We are not driven by a W-88 production schedule or any other weapons production schedule with regard to the plutonium triggers that are produced at Rocky Flats.

UNEXPECTED DETONATIONS

Senator **Wirth**. The Washington Post article says that there have been a number of unexpected detonations, including several incidents that resulted in considerable radiological contamination. Could you give us a list of those for the record? Maybe you are already doing that, but would you provide that list for the record?

Mr. **Tuck**. Yes, sir.

[The information follows:]

DEPARTMENT OF DEFENSE

NARRATIVE SUMMARIES OF ACCIDENTS
INVOLVING U.S. NUCLEAR WEAPONS
1950-1980

Attached are unclassified summaries describing the circumstances surrounding 32 accidents involving nuclear weapons. Also attached is the Department of Defense (DOD)/Department of Energy (DOE) definition of "accident" used in researching this project.

Twenty-six of these summaries were first released by the Air Force in 1977; another was prepared following the Titan II explosion in Arkansas in September 1980. These previously released summaries are marked with a figure "1"; in some cases they include new material made available as a result of more search.*

There never has been even a partial, inadvertent U.S. nuclear detonation despite the very severe stresses imposed upon the weapons involved in these accidents. All "detonations" reported in the summaries involved conventional high explosives (HE) only. Only two accidents, those at Palomares and Thule, resulted in a widespread dispersal of nuclear materials.

Nuclear weapons are never carried on training flights. Most of the aircraft accidents represented here occurred during logistic/ferry missions or airborne alert flights by Strategic Air Command (SAC) aircraft. Airborne alert was terminated in 1968 because of:

—Accidents, particularly those at Palomares and Thule

—The rising cost of maintaining a portion of the SAC bomber force constantly on airborne alert, and,

—The advent of a responsive and survivable intercontinental ballistic missile force which relieved the manned bomber force of a part of its more time-sensitive responsibilities. (A portion of the SAC force remains on nuclear ground alert).

Although normal DOD policy is to neither confirm nor deny the presence of nuclear weapons or components, recently revised DOD Directive 5230.16 governing public affairs guidance allows for confirmation when required to protect public safety or as a means of reducing widespread public alarm. Therefore, in some of the events summarized here, confirmation of presence is not published. Except for Palomares and Thule, it is not possible to specify the location of the accidents that occurred overseas.

Most of the weapons systems involved in these accidents are no longer in the active inventory. Those include the B-29, B-36, B-47, B-50, B-58, C-124, F-100, and F-5M aircraft, and the Minuteman I missile.

With some early models of nuclear weapons, it was standard procedure during most operations to keep a capsule of nuclear material separate from the weapon for safety purposes. While a weapon with the capsule removed did contain a quantity of natural (not enriched) uranium with an extremely low level of radioactivity, accidental detonation of the

HE element would cause neither a nuclear detonation nor contamination. Modern design incorporates improved redundant safety features to insure that a nuclear explosion does not occur as the result of an accident.

This list of accidents was compiled by DOD/DOE researchers during December 1980 - January 1981. The researchers reviewed all available records of the military services and DOE, applying current definition to determine if an event warranted categorization as an accident.

For example, one event not covered by these narratives was included in a "Chronology of Nuclear Accident Statements", released by DOD in 1968:

> The researchers found, however, that only a small retrorocket on the missile had accidentally fired. The missile and its warhead were not damaged. That event does not warrant inclusion in a list of accidents involving nuclear weapons.
>
> Another event from the 1968 list, involving a U.S. Navy Terrier missile (January 1966; NAS Mayport, Florida) was not considered to be an accident, but has been categorized as a significant incident. In that incident, a nuclear warhead separated from the missile, and fell about eight feet. The warhead was dented; no other damage occurred.

The other events in this list, that were also cited in the 1968 "Chronology...", are identified with a figure "2".

The events outlined in the attached narratives involved operational weapons, nuclear materials, aircraft and/or missiles under control of the U.S. Air Force, U.S. Navy, or the Atomic Energy Commission (a DOE predecessor agency). The U.S. Army has never experienced an event serious enough to warrant inclusion in a list of accidents involving nuclear weapons. The U.S. Marine Corps does not have custody of nuclear weapons in peacetime and has experienced no accidents of significant incidents involving them.

To the best of our knowledge, this list is complete. Reporting requirements varied among the Services, (particularly in the earlier period covered by these narratives) so it is possible, but not likely, that an earlier accident has gone unreported here. All later events, however, have been evaluated and are included if they fall within the established definition of an accident.

DEFINITION OF AN ACCIDENT

An "accident involving nuclear weapons" is defined as

- An unexpected event involving nuclear weapons or nuclear weapons components that results in any of the following:

—Accidental or unauthorized launching, firing, or use, by U.S. forces or supported allied forces, of a nuclear-capable weapon system which could create the risk of an outbreak of war.

—Nuclear detonation.

—Non-nuclear detonation or burning of a nuclear weapon or radioactive weapon component, including a fully assembled nuclear weapon, an unassembled nuclear weapon, or a radioactive nuclear weapon component.

—Radioactive contamination.

—Seizure, theft, or loss of a nuclear weapon or radioactive nuclear weapon component, including jettisoning.

—Public hazard, actual or implied.

February 13, 1950 / B-36 / Pacific Ocean, off Coast of British Columbia

The B-36 was enroute from Eilson AFB to Carswell AFB on a simulated combat profile mission. The weapon aboard the aircraft had a dummy capsule installed. After six hours of flight, the aircraft developed serious mechanical difficulties, making it necessary to shut down three engines. The aircraft was at 12,000 feet altitude. Icing conditions complicated the emergency and level flight could not be maintained. The aircraft headed out over the Pacific Ocean and dropped the weapon from 8,000 feet. A bright flash occurred on impact, followed by a sound and shock wave. Only the weapon's high explosive material detonated. The aircraft was then flown over Princess Royal Island where the crew bailed out. The aircraft wreckage was later found on Vancouver Island. * 1

April 11, 1950 / B-29 / Manzano Base, New Mexico

Aircraft departed Kirtland AFB at 9:38 p.m. and crashed into a mountain on Manzano Base approximately three minutes later, killing the crew. Detonators were installed in the bomb on board the aircraft. The bomb case was demolished and some high explosive (HE) material burned in the gasoline fire. Other pieces of unburned HE were scattered throughout the wreckage. Four spare detonators in their carrying cases were recovered undamaged. There were no contamination or recovery problems. The recovered components of the weapons were returned to the Atomic Energy Commission. Both the weapon and the capsule of the nuclear material were on board the aircraft but the capsule was not inserted for safety reasons. A nuclear detonation was not possible. * 1

July 13, 1950 / B-50 / Lebanon Ohio

The B-50 was on a training mission from Biggs AFB, Texas. The aircraft was flying at 7,000 feet on a clear day. Aircraft nosed down and flew into the ground killing four officers and twelve airmen. The high explosive portion of the weapon aboard detonated on impact. There was no nuclear capsule aboard the aircraft. * 1

August 5, 1950 / B-29 / Fairfield/Suison AFB, California

A B-29 carrying a weapon, but no capsule, experienced two runaway propellers and landing gear retraction difficulties on takeoff from Fairfield/Suison AFB (now Travis AFB). The aircraft attempted an emergency landing and crashed and burned. The fire was fought for 12-15 minutes before the weapon's high explosive material detonated. Nineteen crew members and rescue personnel were killed in the crash and/or the resulting detonation, including General Travis. * 1

November 10, 1950 / B-50 / Over Water, outside United States

Because of an in-flight aircraft emergency, a weapon containing no capsule of nuclear material was jettisoned over water from an altitude of 10,500 feet. A high-explosive detonation was observed.

March 10, 1956 / B-47 / Mediterranean Sea

The aircraft was one of a flight of four scheduled for non-stop deployment from MacDill AFB to an overseas air base. Takeoff from MacDill and first refueling was normal. The second refueling point was over the Mediterranean Sea. In preparation for this, the flight penetrated solid cloud formation to descend to the refueling level of 14,000 feet. Base of the clouds was 14,000 feet and visibility was poor. The aircraft, carrying two nuclear capsules in carrying cases, never made contact with the tanker.

An extensive search failed to locate any traces of the missing aircraft or crew. No weapons were aboard the aircraft; only two capsules of nuclear weapons material in carrying cases. A nuclear detonation was not possible. * 1

July 27, 1956 / B-47 / Overseas Base

A B-47 aircraft with no weapons aboard was on a routine training mission making a touch and go landing when the aircraft suddenly went out of control and slid off the runway, crashing into a storage igloo containing several nuclear weapons. The bombs did not burn or detonate. There were no contamination or cleanup problems. The damaged weapons and components were returned to the Atomic Energy Commission. The weapons that were involved were in storage configuration. No capsules of nuclear materials were in the weapons or present in the building.
* 1

May 22, 1957 / B-36 / Kirtland AFB, New Mexico

The aircraft was ferrying a weapon from Biggs AFB, Texas, to Kirtland AFB. At 11:50 a.m. MST, while approaching Kirtland at an altitude of 1,700 feet, the weapon dropped from the bomb bay taking the bomb doors with it. Weapon parachutes were deployed but apparently did not fully retard the fall because of the low altitude. The impact point was approximately 4.5 miles south of the Kirtland control tower and .3 miles west of the Sandia Base Reservation. The high explosive material detonated, completely destroying the weapon and making a crater approximately 25 feet in diameter and 12 feet deep. Fragments and debris were scattered as far as one mile from the impact point. The release mechanism locking pin was being removed at the time of release. (It was standard procedure at that time that the locking pin be removed during takeoff and landing to allow for emergency jettison of the weapon, if necessary). Recovery and cleanup operations were conducted by Field Command, Armed Forces Special Weapons Project. Radiological survey of the area disclosed no radioactivity beyond the lip of the crater at which point the level was 0.5 milliroentgens. There were no health or safety problems. Both the weapon and capsule were on board the aircraft but the capsule was not inserted for safety reasons. A nuclear detonation was not possible. * 1

July 28, 1957 / C-124 / Atlantic Ocean

Two weapons were jettisoned from a C-124 aircraft on July 28 off the east coast of the United States. There were three weapons and one nuclear capsule aboard the aircraft at the time. Nuclear components were not installed in the weapons. The C-124 aircraft was enroute from Dover AFB, Delaware when a loss of power from number one and two engines was experienced. Maximum power was applied to the remaining engines; however, level flight could not be maintained. At this point, the decision was made to jettison at 4,500 feet altitude. The second weapon was jettisoned at approximately 2,500 feet altitude. No detonation occurred from either weapon. Both weapons are presumed to have been damaged from impact with the ocean surface. Both weapons are presumed to have submerged almost instantly. The ocean varies in depth in the area of the jettisonings. The C-124 landed at an airfield in the vicinity of Atlantic City, New Jersey, with the remaining weapon and the nuclear capsule aboard. A search for the weapons or debris had negative results. * 1

October 11, 1957 B-47 / Homestead AFB, Florida

The B-47 departed Homestead AFB shortly after midnight on a deployment mission. Shortly after liftoff one of the aircrafts outrigger tires exploded. The aircraft crashed in an uninhabited area approximately 3,800 feet from the end of the runway. The aircraft was carrying one weapon in ferry configuration in the bomb bay and one nuclear capsule in a carrying case in the crew compartment. The weapon was enveloped in flames and burned and smoldered for approximately four hours after which it was cooled with water. Two low order high explosive detonations occurred during the burning. The nuclear capsule and its carrying case were recovered intact and only slightly damaged by heat. Approximately one-half of the weapon remained. All major components were damaged but were identifiable and accounted for. * 1

January 31, 1958 / B-47 / Overseas Base

A B-47 with one weapon in strike configuration was making a simulated takeoff during an exercise alert. When the aircraft reached approximately 30 knots on the runway, the left rear wheel casting failed. The tail struck the runway and a fuel tank ruptured. The aircraft caught fire and burned for seven hours. Firemen fought the fire for the allotted ten minutes fire fighting time for high explosive contents of that weapon, then evacuated the area. The high explosive did not detonate, but there was some contamination in the immediate area of the crash. After the wreckage and the asphalt beneath it were removed and the runway washed down, no contamination was detected. One fire truck and one fireman's clothing showed slight alpha contamination until washed. Following the accident, exercise alerts were temporarily suspended and MDS B-47 wheels were checked for defects. * 1

February 5, 1958 / B-47 / Savannah River, Georgia

The B-47 was on a simulated combat mission that originated at Homestead AFB, Florida. While near Savannah, Georgia, the B-47 had a mid-air collision with a F-86 aircraft at 3:30 a.m. Following the collision, the B-47 made three attempts to land at Hunter AFB, Georgia, with a weapon aboard. Because of the condition of the aircraft, its airspeed could not be reduced enough to insure a safe landing. Therefore, the decision was made to jettison the weapon rather than expose Hunter AFB to the possibility of a high explosive detonation. A nuclear detonation was not possible since the nuclear capsule was not aboard the aircraft. The weapon was jettisoned into the water several miles from the mouth of the Savannah River (Georgia) in Wassaw Sound off Tybee Beach. The precise weapon impact point is unknown. The weapon was dropped from an altitude of approximately 7,200 feet at an aircraft speed of 180-190 knots. No detonation occurred. After jettison the B-47 landed safely. A three square mile area was searched using a ship with divers and underwater demolition team technicians using Galvanic drag and handheld sonar devices. The weapon was not found. The search was terminated April 16, 1958. The weapon was considered to be irretrievably lost. * 1
** 2

March 11, 1958 / B-47 / Florence, South Carolina

On March 11, 1958 at 3:58 p.m. EST, a B-47E departed Hunter AFB, Georgia, as number three aircraft in a flight of four enroute to an overseas base. After leveling off at 15,000 feet, the aircraft accidentally jettisoned an unarmed nuclear weapon which impacted in a sparsely populated area 6½ miles east of Florence, South Carolina. The bomb's high explosive material exploded on impact. The detonation caused property damage and several injuries on the ground. The aircraft returned to base without further incident. No capsule of nuclear materials was aboard the B-47 or installed in the weapon. * 1
** 2

November 4, 1958 / B-47 / Dyess AFB, Texas

A B-47 caught fire on takeoff. Three crew members successfully ejected; one was killed when the aircraft crashed from an altitude of

1,500 feet. One nuclear weapon was aboard when the aircraft crashed. The resultant detonation of the high explosive made a crater 35 feet in diameter and six feet deep. Nuclear materials were recovered near the crash site.
* 1
** 2

November 26, 1958 / B-47 / Chennault AFB, Louisiana

A B-47 caught fire on the ground. The single nuclear weapon on board was destroyed by the fire. Contamination was limited to the immediate vicinity of the weapon residue within the aircraft wreckage.
* 1
** 2

January 18, 1959 / F-100 / Pacific Base

The aircraft was parked on a reveted hardstand in ground alert configuration. The external load consisted of a weapon on the left intermediate station and three fuel tanks (both inboard stations and the right intermediate station). When the starter button was depressed during a practice alert, an explosion and fire occurred when the external fuel tanks inadvertently jettisoned. Fire trucks at the scene put out the fire in about seven minutes. The capsule was not in the vicinity of the aircraft and was not involved in the accident. There were no contamination or cleanup problems. * 1

July 6, 1959 / C-124 / Barksdale AFB, Louisiana

A C-124 on a nuclear logistics movement mission crashed on take-off. The aircraft was destroyed by fire which also destroyed one weapon. No nuclear or high explosive detonation occurred — safety devices functioned as designed. Limited contamination was present over a very small area immediately below the destroyed weapon. This contamination did not hamper rescue or fire fighting operations.
* 1
** 2

September 25, 1959 / P-5M / Off Whidbey Island, Washington

A U.S. Navy P-5M aircraft ditched in Puget Sound off Whidbey Island, Washington. It was carrying an unarmed nuclear antisubmarine weapon containing no nuclear material. The weapon was not recovered.

October 15, 1959 / B-52 / KC-135 / Hardinsberg, Kentucky

The B-52 departed Columbus Air Force Base, Mississippi at 2:30 p.m. CST, October 15, 1959. This aircraft assumed the #2 position in a flight of two. The KC-135 departed Columbus Air Force Base at 5:33 p.m. CST as the #2 tanker aircraft in a flight of two scheduled to refuel the B-52s. Rendezvous for refueling was accomplished in the vicinity of Hardinsberg, Kentucky, at 32,000 feet. It was night, weather was clear, and there was no turbulence. Shortly after the B-52 began refueling from the KC-135, the two aircraft collided. The instructor

pilot and pilot of the B-52 ejected, followed by the electronic warfare officer and the radar navigator. The co-pilot, navigator, instructor navigator, and tail gunner failed to leave the B-52. All four crewmembers in the KC-135 were fatally injured. The B-52's two unarmed nuclear weapons were recovered intact. One had been partially burned but this did not result in the dispersion of any nuclear material or other contamination. * 1
** 2

June 7, 1960 / BOMARC / McGuire AFB, New Jersey

A BOMARC air defense missile in ready storage condition (permitting launch in two minutes) was destroyed by explosion and fire after a high-pressure helium tank exploded and ruptured the missile's fuel tanks. The warhead was also destroyed by the fire although the high explosive did not detonate. Nuclear safety devices acted as designed. Contamination was restricted to an area immediately beneath the weapon and an adjacent elongated area approximately 100 feet long, caused by drainoff of firefighting water. * 1
** 2

January 24, 1961 / B-52 / Goldsboro, North Carolina

During a B-52 airborne alert mission structural failure of the right wing resulted in two weapons separating from the aircraft during aircraft breakup at 2,000 - 10,000 feet altitude. One bomb parachute deployed and the weapon received little impact damage. The other bomb fell free and broke apart upon impact. No explosion occurred. Five of the eight crew members survived. A portion of one weapon, containing uranium, could not be recovered despite excavation in the waterlogged farmland to a depth of 50 feet. The Air Force subsequently purchased an easement requiring permission for anyone to dig there. There is no detectable radiation and no hazard in the area. * 1
** 2

March 14, 1961 / B-52 / Yuba City, California

A B-52 experienced failure of the crew compartment pressurization system forcing descent to 10,000 feet altitude. Increased fuel consumption caused fuel exhaustion before rendezvous with a tanker aircraft. The crew bailed out at 10,000 feet except for the aircraft commander who stayed with aircraft to 4,000 feet steering the plane away from a populated area. The two nuclear weapons on board were torn from the aircraft on ground impact. The high explosive did not detonate. Safety devices worked as designed, and there was no nuclear contamination. * 1
** 2

November 13, 1963 / Atomic Energy Commission Storage Igloo / Medina Base, Texas

An explosion involving 123,000 pounds of high explosive components of nuclear weapons caused minor injuries to three Atomic Energy Commission employees. There was little contamination from the nuclear components stored elsewhere in the building. The components were from obsolete weapons being disassembled.

January 13, 1964 / B-52 / Cumberland, Maryland

A B-52D was enroute from Westover Air Force Base, Massachusetts, to its home base at Turner Air Force Base, Georgia. The crash occurred approximately 17 miles SW of Cumberland, Maryland. The aircraft was carrying two weapons. Both weapons were in a tactical ferry configuration (no mechanical or electrical connections had been made to the aircraft and the safing switches were in the "Safe" position). Prior to the crash, the pilot had requested a change in altitude because of severe air turbulence at 29,500 feet. The aircraft was cleared to climb to 33,000 feet. During the climb, the aircraft encountered violent air turbulence and aircraft structural failure subsequently occurred. Of the five aircrew members, only the pilot and co-pilot survived. The gunner and navigator ejected but died of exposure to sub-zero temperatures after successfully reaching the ground. The radar navigator did not eject and died upon aircraft impact. The crash site was an isolated mountainous and wooded area. The site had 14 inches of new snow covering the aircraft wreckage which was scattered over an area of approximately 100 yards square. The weather during the recover and cleanup operation involved extreme cold and gusty winds. Both weapons remained in the aircraft until it crashed and were relatively intact in the approximate center of the wreckage area.

* 1
** 2

December 5, 1964 / LGM 30B (Minuteman ICBM) / Ellsworth AFB, South Dakota

The LGM 30B Minuteman I missile was on strategic alert at Launch Facility (LF) L-02, Ellsworth AFB, South Dakota. Two airmen were dispatched to the LF to repair the inner zone (IZ) security system. In the midst of their checkout of the IZ system, one retrorocket in the spacer below the Reentry Vehicle (RV) fired, causing the RV to fall about 75 feet to the floor of the silo. When the RV struck the bottom of the silo, the arming and fusing/altitude control subsystem containing the batteries was torn loose, thus removing all sources of power from the RV. The RV structure received considerable damage. All safety devices operated properly in that they did not sense the proper sequence of events to allow arming the warhead. There was no detonation or radioactive contamination.

* 1

December 8, 1964 / B-58 / Bunker Hill (Now Grissom) AFB, Indiana

SAC aircraft were taxiing during an exercise alert. As one B-58 reached a position directly behind the aircraft on the runway ahead of it, the aircraft ahead brought advanced power. As a result of the combination of the jet blast from the aircraft ahead, the icy runway surface conditions, and the power applied to the aircraft while attempting to turn onto the runway, control was lost and the aircraft slid off the left hand side of the taxiway. The left main landing gear passed over a flush mounted taxiway light fixture and 10 feet farther along in its travel, grazed the left edge of a concrete light base. Ten feet farther, the left main landing gear struck a concrete electrical manhole box, and the aircraft caught on fire. When the aircraft came to rest, all three crew members aboard began abandoning the aircraft. The aircraft commander and defensive systems operator egressed with minor injuries. The navigator ejected in his escape capsule, which impacted 548 feet from the aircraft. He did not survive. Portions of the five nuclear weapons on board burned; contamination was limited to the immediate area of the crash and was subsequently removed. * 1

October 11, 1965 / C-124 / Wright-Patterson AFB, Ohio

The aircraft was being refueled in preparation for a routine logistics mission when a fire occurred at the aft end of the refueling trailer. The fuselage of the aircraft, containing only components of nuclear weapons and a dummy training unit, was destroyed by fire. There were no casualties. The resultant radiation hazard was minimal. Minor contamination was found on the aircraft, cargo, and clothing of explosive ordnance disposal and fire fighting personnel, and was removed by normal cleaning. * 1

December 5, 1965 / A-4 / At Sea, Pacific

An A-4 aircraft loaded with one nuclear weapon rolled off the elevator of a U.S. aircraft carrier and fell into the sea. The pilot, aircraft, and weapon were lost. The incident occurred more than 500 miles from land.

January 17, 1966 / B-52 / KC-135 / Palomares, Spain

The B-52 and the KC-135 collided during a routine high altitude air refueling operation. Both aircraft crashed near Palomares, Spain. Four of the eleven crewmembers survived. The B-52 carried four nuclear weapons. One was recovered on the ground and on April 7, one was recovered from the sea. Explosive materials exploded on impact with the ground, releasing some radioactive materials. Approximately 1400 tons of slightly contaminated soil and vegetation were removed to the United States for storage at an approved site. Representatives of the Spanish government monitored the cleanup operation. * 1
** 2

January 21, 1968 / B-52 / Thule, Greenland

A B-52 from Plattsburgh AFB, New York, crashed and burned some seven miles southwest of the runway at Thule AB, Greenland while approaching the base to land. Six of the seven crewmembers survived. The bomber carried four nuclear weapons, all of which were destroyed by fire. Some radioactive contamination occurred in the area of the crash, which was on the sea ice. Some 237,000 cubic feet of contaminated ice, snow and water, with crash debris, were removed to an

approved storage site in the United States over the course of a four-month operation. Although an unknown amount of contamination was dispersed by the crash, environmental sampling showed normal readings in the area after the cleanup was completed. Representatives of the Danish government monitored the cleanup operations. * 1
** 2

Spring 1968 / At Sea, Atlantic

Details remain classified.

September 19, 1980 / Titan II ICBM / Damascus, Arkansas

During routine maintenance in a Titan II silo, an Air Force repairman dropped a heavy wrench socket, which rolled off a work platform and fell toward the bottom of the silo. The socket bounced and struck the missile, causing a leak from the pressurized fuel tank. The missile complex and the surrounding area were evacuated and a team of specialists was called in from Little Rock Air Force Base, the missile's main support base. About 8½ hours after the initial puncture, fuel vapors within the silo ignited and exploded. The explosion fatally injured one member of the team. Twenty-one other USAF personnel were injured. The missile's reentry vehicle, which contained a nuclear warhead, was recovered intact. There was no radioactive contamination. * 1

Senator WIRTH. I understand what you are saying about this, but let me go on to tell you why I am concerned. I sent a letter to the Admiral on the third of April asking for a list of all of the problems that exist at Rocky Flats that you have identified, and asking that a list of amelioratory actions be sent to me with a date of completion.

I received a reply to my letter that did not respond to the letter. I would like to ask you again if you might ask your staff to take a look at that letter and see if we might be able to get such a catalogue of actions in response to my April letter.

The Secretary had said up here in testimony, and we sent the quotes from his testimony to you, that he would not reopen Rocky Flats until these two outside studies were completed and could certify that the plants were safe to operate. He said that to us, and I will submit these for the record, if I might, Mr. Chairman, on April 3 in testimony before the Energy Committee and on May 1 in testimony before the Armed Services Committee.

Senator EXON. Without objection, the information will be included in the record.

[The information follows:]

S. Hrg. 101-844

WASTE ISOLATION PILOT PLANT LAND WITHDRAWAL

HEARINGS

BEFORE THE

COMMITTEE ON ENERGY AND NATURAL RESOURCES UNITED STATES SENATE

ONE HUNDRED FIRST CONGRESS

SECOND SESSION

ON THE

DEPARTMENT OF ENERGY'S WASTE ISOLATION PILOT PLANT

AND

S. 2420

TO WITHDRAW CERTAIN PUBLIC LANDS IN EDDY COUNTY, NM, AND FOR OTHER PURPOSES

APRIL 3 AND 26, 1990

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Senator WIRTH. Let me jump now if I might to the reopening of Rocky Flats, Mr. Secretary.

Last fall when the operations at Rocky Flats were suspended and when you replaced Rockwell, you said that you would not be bound by any set dates, that you were only going to do what was safe and that you would submit to an independent review before operations were resumed. That is still your plan, I presume?

Secretary WATKINS. That is correct. We will actually have two independent reviews, one done by the Nuclear Facilities Safety Oversight Board set up by the Congress under Mr. Conway, and one under former Chairman of the Regulatory Commission Mr. Ahearne under the Advisory Committee on Nuclear Facilities Safety. Those act very independently of me. I do not give any specific guidance as to what they should report on and so forth.

Senator WIRTH. What is their schedule for this independent review?

Secretary WATKINS. I could provide that for the record. It is a very extensive schedule in and out. They are reviewing documents, they are going out there by individuals and sometimes as a group.

In fact, Mr. Ahearne was just out there and gave us another review on his concerns and so forth.

Senator WIRTH. When will these two independent reviews be completed?

Secretary WATKINS. Before we start.

Senator WIRTH. What is the date for that?

Secretary WATKINS. I cannot tell you the date because I am not ready to put out my start-up plan yet. They are going to want to stay in the game right up to the last minute.

Senator WIRTH. Will those independent reviews be open for public comment?

Secretary WATKINS. Open for public comment, for public consumption? Yes, sir.

Secretary WATKINS. The independent review, Senator Wirth, is going on as we speak here today. The two independent groups, looking at the data, reviewing it, visiting Rocky Flats. This is an ongoing effort. This does not just happen on a day. This is ongoing all the time, reviewing all the specifications.

Senator WIRTH. But, for the record, we are not planning the resumption of operations at Rocky Flats until the independent review is completed?

Secretary WATKINS. That is correct.

DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEAR 1991

TUESDAY, MAY 1, 1990

U.S. SENATE,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

DEPARTMENT OF ENERGY FACILITIES, COMPLEX MODERNIZATION, AND ENVIRONMENTAL AND WASTE MANAGEMENT ACTIVITIES

Senator WIRTH. Thank you, Mr. Chairman. I appreciate your forbearance and, Secretary Watkins, thank you very much for being here and for undertaking this increasingly thankless task.

I have two questions related to your testimony on page 18. As you can imagine, they are related to Rocky Flats. The first one is the issue of the restart of Rocky Flats. When will the Advisory Committee on Nuclear Facility Safety and the Defense Nuclear Facilities Safety Board studies be completed?

Secretary WATKINS. Senator Wirth, I signed a letter to you this morning which responds to your request after the WIPP hearings before the Energy and Natural Resources Committee of about a month ago. I enclosed a copy of an April 20 letter from the Ahearne Committee, the Advisory Committee on Nuclear Facility Safety, that relates its track record to date—what has been done, all of the things the committee reviewed, and the problems that were found. The entire list, which consists of three or four pages of detailed documentary review, plans, intended plans to continue. I think you will find it very useful.

Also, we are planning two formal public hearings from the time we announce restart later on this month until we actually move through the system. We also will have two formal press conferences where I am going to invite all of the players to come. We certainly we will invite the oversight boards to give their presentations.

In the meantime, we will keep passing to you the information that we get from the Defense Nuclear Facilities Safety Board, which does not work for me. I have to be a little bit cautious there. I do not know what the Board's schedule and plans are, but we provide everything requested.

Senator WIRTH. Will they be done by the 1st of June or so, do you think?

Secretary WATKINS. We will not start up until the Board completes its review. Our present plan, including the reviews and knowing their concerns from earlier communications, we are targeting mid-June when EG&G hopes they will resume operations in the first building. I am reviewing that plan now to determine whether I am willing to accept mid-June, knowing all the various things that have to be pieced together. I have not agreed to that, but that is the EG&G proposal.

Senator WIRTH. What are you currently predicting for the restart of Rocky Flats?

Secretary WATKINS. Two buildings in June. The remaining buildings in July.

Senator WIRTH. That means those two studies will be done, correct?

Secretary WATKINS. Yes, sir, but I am not sure what you mean by studies. Studies to me mean an aggregate, a wealth of documentation, now, for 6 months.

Senator WIRTH. Well, I am only quoting you that you had said that Rocky Flats would not start again until the studies have certified that appropriate corrective actions have been implemented.

Secretary WATKINS. That is correct.

Senator WIRTH. And that Rocky Flats is set to reopen.

Secretary WATKINS. I am just saying that the term studies does not imply that you will get a formal single thin document. I will be able to give you the volume of documents that we get.

Senator WIRTH. We will have a certification that appropriate corrective actions have been implemented and that Rocky Flats is safe to reopen?

Secretary WATKINS. Yes, sir, you will.

Senator WIRTH. We will have those certifications from those two groups?

Secretary WATKINS. I will have the certification from the two groups.

Senator WIRTH. And that will be, obviously, part of your public hearing and so on?

Secretary WATKINS. Yes, sir, it will be.

Senator WIRTH. In your testimony this morning, as I heard you, you added the words, not only safe to operate, but you added the words, "or action plans prepared." Maybe I misheard you. That is the first time those words have appeared anywhere, "or action plans prepared," which is a significantly different statement from the Department about whether you are going to be able to certify from independent sources that Rocky Flats is safe to open before it opens. So this problem exists.

We then go on to the problem that we don't have either of these studies done, and yet you are announcing that you are reviewing a plan to open Rocky Flats, two buildings in June and four more soon thereafter, despite the fact that the Secretary has said we are not going to restart Rocky Flats until it is certified to be open.

Finally, we hear that at this morning's meeting of the Ahearne Committee, that they don't think Rocky Flats could open at least until January, and probably a good deal of time after that.

Now, I have difficulty understanding why we continue to rush in to restart Rocky Flats when we do not have certification from these outside groups that they are ready to open, why we are changing some of the criteria—if I understood you this morning in adding, "or action plans prepared." The Ahearne Committee says, according to discussions of this morning, that it will take at least 6 months to solve the significant safety problems and probably longer than that.

I am a little confused. There are literally hundreds of thousands of people who live right outside of Rocky Flats, right downwind from Rocky Flats, in one of the windiest corridors of the United States of America. Now, I keep emphasizing this, Mr. Tuck, because you have to understand how sensitive this issue is, for very good reason. You know that neither you nor I would build Rocky Flats there again if we had to do it. That was a bad decision made in the 1950s, to put Rocky Flats right next to a major metropolitan area. But that has been done. Now we are faced with the problem—you, me, the Secretary, all of us—of what to do with it. So I just repeat all of that for the record and ask you again, how does your schedule for restarting Rocky Flats jibe with what the Secretary has said?

Mr. TUCK. What we have is a proposal before us from EG&G, our contractor at Rocky Flats, a proposed schedule, which has yet to be endorsed or subscribed to or perfected or made the Department of Energy's schedule. So, for the record, let's state that there is no approved Department of Energy schedule for normalization of operations at Rocky Flats.

What is out there is a proposal by our contractor, EG&G, which has been briefed to Admiral Watkins, which has been briefed to the committee, which has been briefed to the Governor, and which has been briefed to all interested committee and non-committee Members of Congress, that is, non-Armed Services Committee Members of Congress who have asked to get the briefing.

Having said that, already in public hearings last week we have had indication in Colorado that EG&G may seek to modify its schedule, as it was identified as recently as 3 weeks ago. But the point is the Department of Energy does not have, has not endorsed, has not signed up to, has not said that those steps that are identified in the schedule that EG&G has discussed publicly and with all the people I just mentioned, is the Department of Energy's final approved plan of action.

Why is the Department of Energy not taking a step to say that EG&G's plan is the Department of Energy's plan? It is because the Department of Energy wants to have benefit of the Defense Nuclear Facilities Safety Board's insight, the Ahearne Committee's insight, the Mattson Committee or the SCIENTECH study's insight. All of these other factors are going to have to be known to the Secretary before he is in a position to say what schedule he will promulgate with regard to normalization of operations at Rocky Flats. This is why we have not said anything as yet. I do think it is confusing. But what we are trying to do is to keep everybody apprised of those elements of information which are critical to these decisions as they become available.

We think that the people in Denver should know exactly what is at issue. That is why I have asked today and received permission of the committee to make public the most recent interim letter report from SCIENTECH, from Mr. Mattson, with regard to his views with regard to the criticality issue and the plutonium in the ducts.

We are trying to let people know what is going on. We have a new way of doing business at the Department of Energy. It is called "openness," and we are not trying to hide anything. We are trying to make sure that all concerned, all interested parties, are apprised of those actions that we are taking to make this situation better. That is the way we intend to proceed.

When Admiral Watkins is satisfied that he has the input from the independent external oversight bodies that I mentioned and the experts that he has on his staff, then he will decide how he will proceed and when he will permit normalization of operations to continue, and not before. I just state for the record that it is not being driven by any production schedule for any specific weapon. It is to be made in 1990, 1991, 1992, or any time in the future. He will operate, or he will permit to be operated, or normalize the operations at Rocky Flats, when he is ready to and is comfortable that the margin of safety is sufficient to permit that to happen, to go on.

Yes, you have a lot of people in this game. A lot of people have a lot of points of view and they should be heard, in open forum. That is exactly the process that you are witnessing. It is a little cacophonous. It is confusing. But the person who will bring order out of that chaos will be Admiral Watkins, when he decides and promulgates that schedule.

Senator WIRTH. Mr. Chairman, I appreciate the time, but I would try again, Mr. Chairman, to see why there is a disconnect between what Mr. Watkins has said and what the Department is proposing to do. I will try again in a letter to see if we can pin that down. I understand the process you are going through, I respect the process you are going through, but the question still has not been answered. I will try to do it and maybe write the question out, again, as we have done on a number of occasions, Mr. Tuck, and try it once more. I appreciate your being here. Thank you, Mr. Chairman.

Senator EXON. Thank you, Senator Wirth. Senator Levin.

NEW PRODUCTION REACTORS

Senator LEVIN. Thank you, Mr. Chairman. Mr. Tuck, I would like to talk to you about tritium production. I believe in your answer to Senator Thurmond you indicated that you had not yet decided on whether to proceed with two New Production Reactors and will not be doing that until the end of 1991. Is that correct?

Mr. TUCK. What I responded to Senator Thurmond, which was amplified by Dom Monetta of our Department, was that the process that we are following, the NEPA process, dictates that a record of decision with regard to how we will proceed on New Production Reactors will not be made until late 1991.

Senator LEVIN. Is that different from "yes?" I'm not sure if that just isn't "yes."

Mr. TUCK. I guess the short answer, Senator, is yes. The idea is that we are trying to do this in conformance with a structure that is the law.

Senator **Levin**. Well, for whatever reason, you are not going to be making a decision on two New Production Reactors until the end of calendar 1991, is that right?

Mr. **Tuck**. That's correct, a final decision.

Senator **Levin**. I do believe you also gave us an estimate as to the cost in current dollars of those two reactors and that that estimate was $11 billion. Did I hear that correctly?

Mr. **Tuck**. That is the testimony of Mr. Monetta. Yes, sir.

Senator **Levin**. That is a significantly different figure from what we have had before. Can you give us the breakdown of that? How much is for each of the two reactors?

Mr. **Tuck**. Certainly. Let me ask Mr. Monetta to return to the table.

Senator **Levin**. Two figures are all that I need that total the $11 billion. How much is the New Production Reactor at Savannah River, and how much is the high temperature gas reactor?

Mr. **Monetta**. The numbers are usually stated in fiscal year 1988 dollars, Senator. That number, that has been stated for the record, is $6.8 billion. The number I stated was the accelerated number, based upon the fiscal year 1990 run-out, at around 4.2 percent inflation per year. Now your question is how much have we spent to date on those two reactors?

Senator **Levin**. No. You can't get from $6.8 billion to $11 billion with 4 percent inflation in 2 years.

Mr. **Monetta**. Now, this is not 4 percent inflation in 2 years. This is 4.2 percent inflation over the remaining 10 years of the program.

Senator **Levin**. Except the $11 billion was in current dollars and not in then-year dollars.

Mr. **Monetta**. The $11 billion is the total cost of the program as we project it.

Senator **Levin**. In current dollars or then-year dollars?

Mr. **Monetta**. In then-year dollars.

Senator **Levin**. Oh. That's very different. The answer was given before in current dollars.

Mr. **Monetta**. I'm sorry. I misspoke.

Senator **Levin**. Admiral Watkins has told us that we could produce 100 percent of our current inventory need at the New Production Reactor at Savannah for that $3.2 billion, and that the second reactor, the high temperature gas reactor, would produce 50 percent of our current inventory need, but at $3.6 billion in current dollars.

REVISION OF TRITIUM REQUIREMENT

Mr. Tuck, this question is for you. If we enter into a START agreement and reduce our need for tritium, will you revise your inventory requirement?

Mr. **Tuck**. Well, the stockpile structure defines our requirement, coupled with the working inventory, coupled with the reserve that we are mandated to have on-hand. We do not define that. The stockpile structure defines that.

Senator **Levin**. If the strategic nuclear warheads are reduced by 30 percent in a START agreement, and if we also eliminate some short-range nuclear weapons in Europe, will the Department of Energy revise its tritium requirement for the future downward?

Mr. TUCK. We will revise our tritium figure upward or downward, depending upon what the structure is of the nuclear weapons stockpile memorandum, how many weapons we are directed to build, sustain, or maintain in an inventory. Therein lies the problem.

Senator LEVIN. Have you looked at the proposed START agreement at all?

Mr. TUCK. Yes, sir.

Senator LEVIN. And if it is signed the way it is proposed or generally proposed, will you then, based on what you believe is likely to happen, then revise your tritium requirement downward?

Mr. TUCK. Yes, sir.

Senator LEVIN. So, at that point, if we do have a START agreement and you act as you just said you would, based on your knowledge of that agreement, we would know within a year or so whether or not the New Production Reactor at Savannah would, indeed, even give us more than 100 percent of what is expected to be our tritium requirement. Is that correct?

Mr. TUCK. That's correct. We will know a year—well, at the record of decision, which is December of 1991, or thereabouts—but we will know these things as modifications are made to our stockpile memorandum, which is not just once a year. It is perfected, massaged, structured, changed.

Senator LEVIN. Is it not true, then, that if a START agreement is signed as predicted, projected, outlined, that we will then, with just that one reactor at Savannah, the new one, have more than 100 percent of our tritium requirement produced at that one reactor?

Mr. TUCK. In short, yes.

REQUEST FOR CONSTRUCTION MONEY

Senator LEVIN. Yes? Okay. That's helpful. Now, this year, the Department of Energy has requested $363 million for the two proposed production reactors, including $220 million for construction. As I understand it, you have not made a decision yet to proceed because that is not going to be done until 1991, or the end thereof. Can you tell us why it is that you are requesting construction money in 1991?

Mr. MONETTA. Senator, that term is a misnomer in the Department of Energy budget. We are actually allocating that money to design of the reactors; that is, Title I, preliminary design, uses "construction dollars." We are not turning ground with that money.

Senator LEVIN. My time is up. Thank you.

Senator EXON. Thank you, Senator Levin. Senator Gore.

LEVEL OF ENVIRONMENTAL CONTAMINATION

Senator GORE. Thank you very much, Mr. Chairman. To Mr. Tuck and your colleagues, welcome. In February of this year your Department released its Tiger Team assessment of the Y-12 plant in Oak Ridge. It had some good things to say about progress, safety, and environmental procedures. But it also noted that there were continuing problems in reducing the amount of mixed waste and storage and in identifying, eliminating, diverting, or collecting and treating all of its waste water discharges. There also seemed to be some holes in the procedures for guarding against radiation hazards to employees.

This month, as I am sure you know, the press carried stories to the effect that a Department of Energy contractor has now reported that its review shows that plutonium may still be leaking out of pits where it is buried into the Clinch River and the Watts Bar Reservoir and the Watts Bar Reservoir system. As you know, we have a copy of the report, which was, in fact, done by Martin Marietta at Oak Ridge National Laboratory. The report, as far as I can tell, is not classified. I am prepared to quote from it, if that is all right with you.

Mr. **Tuck**. Yes, sir.

Mr. **Duffy**. Yes, sir.

Senator **Gore**. It does not have a classification on its face. It says the main conclusions are, and I quote: "previously reported concentrations of radio nucleides in water, sediment, and biota of the Clinch River and Watts Bar Reservoir suggest the presence of a variety of contaminants of possible concern to the protection of human health and the environment."

I continue in a related passage: "the ratio of plutonium 238 to plutonium 239 and 240 on the suspended particles in Watts Bar Reservoir is about a factor of three higher than the same ratio in global fallout delivered to mid-latitude areas of the northern hemisphere. This suggests that some of the plutonium disposed of or stored on the reservation is being transported into off-site areas."

Quoting again: "Watts Bar Reservoir serves as a very efficient trap for riverborne particles, nutrients, and contaminants and is, therefore, a site of rapid sediment and contaminant accumulation." I add my own note here that, as you know, other substances of concern include mercury, of which large quantities were released into the river in the mid-1950s.

In the final quotation from the report: "the scoping study was conducted to provide a preliminary characterization of contamination in off-site areas to help design sampling strategies in environmental risk and human health assessments and to identify specific off-site areas requiring more detailed work."

One final phrase: "these more extensive characterizations will be used to evaluate the need for remediation activities designed to reduce human health and environmental risks."

Now, what is your evaluation of this report? Is the situation stable? Is it getting worse? How do you evaluate the present risk in the situation? At what point will we have a clear idea of the level of risk and the extent of the needed remedy? If you could briefly address those related questions, I would appreciate it.

Mr. **Tuck**. Senator, with your permission, I would like to ask our expert in these areas, Mr. Leo Duffy, to respond to your question.

Senator **Gore**. Surely. That would be fine.

Mr. **Duffy**. Senator, as you know, the Oak Ridge Laboratory and the Oak Ridge Complex have had a long history of releases into the environment over the last 40 years; the 500 pounds of mercury that you identified and some uranium discharges over the past. I think the analysis initially indicated that about 235 acres of the Oak Ridge Complex have resulted in contamination of about 35,000 acres in the vicinity of the operation, mostly in the East Fork, North Fork, Poplar Creek, White Oak Creek, White Oak Reservoir, Clinch River, and Clinch River Reservoir. These contamination levels are fairly close to background; as indicated, a factor of two above fallout operation.

We are in a factor of three. I think, if you look at the total, it could be two to three. That is in the picocurie range, which should not be a health hazard at the present time. Disturbing the sediment in the reservoir would not be the right thing to do, I think, at the present time, until we understand the full extent of it.

Is it getting worse? No. The answer is, it is not getting worse. Most of this is the result of past practices. In the remedial investigation we have 20 major areas that we identified for the Oak Ridge Complex, 171 sites. We have just completed the tenth of 13 remedial investigation programs. So we are getting a handle on the program. I don't think it is a safety problem at the present time. As soon as we complete the remedial investigation, which this report is one of, we will then come up with a feasibility study on what to do with the material in the reservoir.

Senator GORE. What is your timeframe on that again?

Mr. DUFFY. The timeframe on the feasibility study, I would believe, would be within 18 months of the remedial investigation.

Senator GORE. But it is your considered judgment that the current situation is not characterized by continuing releases, is that right?

Mr. DUFFY. That's right.

Senator GORE. You think what the contractor found there does not suggest continuing releases, but merely the accumulated problem. When do you think the release occurred?

Mr. DUFFY. I would think back in the late 1950s or early 1960s, but I am not sure. I could do an evaluation of the last time they measured the activity, specific isotopes, and what the distribution was in processing at that time, and that would tell us a better timeframe.

Senator GORE. If you could provide that for the record, I would appreciate that very much.

Mr. DUFFY. Yes, sir.

[The information follows:]

There is an ongoing effort at Oak Ridge Reservation by the Department's management and operating contractor, Martin Marietta Energy Systems, Inc., to (1) define the nature and extent of contamination of off-site surface water environment downstream from the Oak Ridge Reservation; (2) quantify risks to the environment and to human health and welfare resulting from existing off-site contamination; and (3) identify and evaluate potential corrective measures. This activity started in fiscal year 1989 with data synthesis and screening level risk analysis to identify additional data requirements. Preliminary sampling and analysis in selected areas began in fiscal year 1990 will continue in fiscal year 1991, with more extensive sampling to follow through fiscal year 1992. Iterative risk analyses were performed beginning in fiscal year 1990 and will continue for some time to focus the need for additional data. Preliminary identification and evaluation of potential corrective measures will begin in fiscal year 1991. These activities are identified in the Department's original Environmental Restoration and Waste Management Five-Year Plan (fiscal year 1991-fiscal year 1995). This work has been documented in three reports: ORNL/ER-7, "Transport and Accumulation of Cesium-137 and Mercury in the Clinch River and Watts Bar Reservoir System"; ORNL/ER-8, "Screening Level Risk Assessment for Off-site Ecological Effects in Surface Waters Downstream from the U.S. Department of Energy Oak Ridge Reservation"; and ORNL/ER-9, "Preliminary Screening of Contaminants in the Off-site Surface Water Environment Downstream of the U.S. Department of Energy Oak Ridge Reservation." Findings to date are that (1) the reservoir efficiently retains sediment and particle-associated contaminants; (2) contamination of reservoir sediments by cesium–137, mercury, and others that are particle is associated primarily with fine sediments located in deep water in the old Clinch River Channel; (3) the highest concentrations of cesium–137 and mercury are isolated deep in the bottom sediment; (4) most of the releases occurred in the mid- to late-1950s; and (5) preliminary human health and environmental risk screening analyses revealed no short-term imminent risks and indicated that most of the contaminants previously reported to occur in the Clinch River-Watts Bar Reservoir environment should be included for additional evaluation in the Clinch River remedial investigation/feasibility study (RI/FS) required under provisions of the Resource Conservation and Recovery Act (RCRA). The Department believes that the RI/FS process will provide a comprehensive investigation of off-site surface water contamination.

(The reports (3) are retained in committee files.)

Senator GORE. When will you know what to do?

Mr. DUFFY. I can't really say, but I would say within the 18-month period. We would have an alternatives analysis that would identify what should be done with respect to clean-up operations.

Senator GORE. My time has expired, so I will pursue this and a few other subjects in written questions. If you would, Mr. Tuck, and all of you, please be prepared to respond to those in writing. I would appreciate it.

Mr. TUCK. Yes, sir.

Senator GORE. Thank you, Mr. Chairman.

Senator EXON. Thank you very much, Senator Gore. Senator Nunn, do you have any questions?

STATUS OF PROHIBITED AIR SPACE PROPOSAL

Senator NUNN. Yes, Mr. Chairman, just a couple. Mr. Tuck, at the May 1 hearing Admiral Watkins testified that the public comment period on the Department of Energy proposal to establish prohibited air space over certain Department of Energy facilities would close May 17. Do you know the nature of the comments received, and particularly what the next step is in the process on this one?

Mr. TUCK. Mr. Chairman, I believe the comment period closed on the seventh, and we are reviewing those comments. We will aggregate them and forward them to the FAA. But, in terms of a specific calendar of actions, I will get that for you. I do not have it available at present.

Senator NUNN. That would be fine.

[The information follows:]

The comment period closed on May 15, 1990. The nominal milestones of future airspace events, which have been agreed upon by both the Department of Energy (DOE) and the Federal Aviation Administration (FAA), are as follows:

- July 15, 1990: DOE/FAA review of comments completed.
- September 15, 1990: Notice of Proposed Rulemaking issued.
- November 15, 1990: Comment period ends.
- February 15, 1991: Final Rule issued.
- August 15, 1991: Final Rule becomes effective.

STATUS OF K–REACTOR

Senator NUNN. What is the status of the litigation or the threat of litigation over the K-Reactor cooling tower at Savannah River?

Mr. **Tuck**. We received notification of intent to sue in the latter part of March. If you will permit, I would like to ask Stephen Wakefield, our General Counsel, to give you an update since that timeframe.

Mr. **Wakefield**. That is the status today, Senator Nunn. We have received a letter from an environmental group threatening litigation. There have been no further developments to my knowledge.

Senator **Nunn**. Is there any way you can tell now what impact this would have on the restart of the K-Reactor, or would you have to wait until litigation to tell?

Mr. **Wakefield**. We anticipate that it will have none because we believe that we have adequate permits to go forward from the State. Now, should we lose the litigation, presumably we could not start the reactor until such time as we have the tower in place.

FORECAST OF SAVANNAH RIVER TRITIUM PRODUCTION

Senator **Nunn**. Mr. Tuck, in an article dated May 15 in the Washington Times, you stated: "it is uncertain whether the 1950s-era reactors at Savannah River will be able to generate enough power to produce tritium." Is that an accurate statement? If so, would you explain it?

Mr. **Tuck**. Yes, sir. I stand by that statement. We will know, when we go critical in K in December, and figure out what power levels we can get to. We are hopeful that we can achieve the necessary power levels to make the quantities we require, or achieve goal. But we won't know until then.

Senator **Nunn**. You won't know for sure?

Mr. **Tuck**. We won't know for sure.

Senator **Nunn**. But what is your projection now? What do you think?

Mr. **Tuck**. We have no indication to the contrary.

Senator **Nunn**. To the contrary of what?

Mr. **Tuck**. That they will not be able to meet our production goals. What I am saying is that we are not in a position to know exactly what levels of power those reactors will be able to operate at until the first one goes critical in December and starts production of tritium in January.

Senator **Nunn**. Somebody must think they will have enough power to produce tritium, right?

Mr. **Tuck**. We have all our eggs in the Savannah River basket with regard to tritium production, yes, sir.

Senator **Nunn**. It is not just a toss-up, is it? That's the way this sounds. We are spending an awful lot of money if it is just a toss-up.

Mr. **Tuck**. It is not intended to make it sound like a toss-up whatsoever.

Senator **Nunn**. So, on a scale of one to ten, what are the odds that the Energy Department is projecting that there is going to be enough power to produce tritium? Just give me some range. This sounds very pessimistic, the way it is worded.

Mr. **Tuck**. I think we are fairly confident with two. There are two that we have completed the ultrasonic testing on, but we have not completed ultrasonic testing on all three reactors. So I think the answer to your question is that we are fairly confident we will be able to bring two reactors on-line—those two that we have completed that portion of ultrasonic testing for—to get to sufficient power levels. We will know more after completion of the ultrasonic testing of the third, which will be this summer.

Senator NUNN. Is that the equivalent of a definite maybe?

Mr. TUCK. It is the equivalent of a definite maybe, yes, sir.

ROLE OF NATIONAL LABORATORIES

Senator NUNN. In terms of new directions for the Department of Energy laboratories as the weapons design work diminishes with arms control progress that we hope will take place, would the labs have the ability to contribute to research and development in the area of environmental cleanup and technology?

Mr. TUCK. Absolutely, Mr. Chairman. That is exactly the direction in which Admiral Watkins is going. He is seeking to dedicate some portion of the Environmental Restoration and Waste Management dollars that are segregated for that purpose to be for research, and that is roughly 10 percent. In 1991, I think that equates to some $206 million. It is our hope and expectation that we will be able to find additional dollars, not only as that fund grows, but as Congress looks at the problem to see if the national laboratories could take even a larger role and commit even larger resources to the task of environmental restoration and waste management technology development.

Senator NUNN. Would the laboratories be able to go beyond simply the environmental cleanup and technology needed for governmental purposes and be able to develop technology for broader purposes—for instance, the Clean Air Act, the Clean Water Act, that kind of thing?

Mr. TUCK. Yes, sir.

Senator NUNN. Do you think that kind of talent is there?

Mr. TUCK. We know that kind of talent is there.

Mr. DUFFY. Our research program is designed for technology transfer into the private sector, looking at not just the recovery operation but the instrumentation that goes along with measurements of very small parts per billion, parts per million, which you would get in emissions from the Clean Air Act, which we get in the Clean Water Act. That is where the program is being directed at the present time.

Senator NUNN. Do you have the capacity to take on more in this area if you are given more funding?

Mr. DUFFY. Yes, sir. In the research area, with the new research design, development, test, and engineering program, we could expand that research. We are working with private enterprise on a basis of sharing the technology as it has developed and bring it to the commercial end so that we are competitive. We have to be competitive on the tail end of all our industrial cycles or we are going to lose out to the Third World nations. If we don't solve the problem, we will be putting money into environmental cleanup when they are not going into environmental cleanup, as we have seen in

Eastern Europe. So we have to do that, and that is what the Secretary's program is dedicated to.

Senator NUNN. Thank you, Mr. Chairman.

STATUS OF K-REACTOR

Senator EXON. Thank you. Let me follow up on a question that you asked legal counsel. I hate to get into the middle of two lawyers, but as I understood the answer to the Chairman's question, you said that you felt that the Department had met all of the environmental and other standards and, therefore, even if a lawsuit were filed, you thought it would not be likely to impair the proposed December opening. Is that right?

Mr. WAKEFIELD. When you say, "all of the environmental requirements," I was speaking only to the question of whether we had a permit to permit thermal discharge at K-Reactor, which I believe was Senator Nunn's question. But, yes, we believe that we have that permit and think that we can defend the lawsuit. Yes.

Senator EXON. But "defending the lawsuit," the question still remains. You could defend the lawsuit but that could take some time. What are you anticipating? Do you feel that your position is strong enough that you could convince the judge that the lawsuit maybe should go ahead and be tried, but not to stop the beginning of tritium production? Is that what you are saying?

Mr. WAKEFIELD. That's correct. We do not think that a judge would stay the commencement of production at K-Reactor because of the lawsuit as we have had the lawsuit indicated in the correspondence.

Senator EXON. That ends our first round. I am going to withhold my further questions and submit them for the record, asking you to reply as quickly as possible, Mr. Secretary. I would like to ask the other members of the committee and those here if they could do likewise so that we could move ahead to our closed session.

Senator WIRTH. Mr. Chairman, may I ask one more set of questions?

Senator EXON. Yes.

ROCKY FLATS CERTIFICATION

Senator WIRTH. Thank you, Mr. Chairman. Mr. Tuck, on May 1 I asked the Secretary, "we will have a certification that appropriate corrective actions have been implemented and that Rocky Flats is safe to reopen."

Secretary Watkins replied, "yes, sir, we will."

I said, referring to the Conway and Ahearne groups, "we will have these certifications from these two groups."

Secretary Watkins responded, "I will have the certification from the two groups."

I assume that that is still the Department's policy. Is that correct?

Mr. TUCK. You will certainly have a certification from Admiral Watkins. That will be exactly what he is paid to do, and that is to ascertain or to make a decision that it is proper to proceed with the schedule.

Senator **Wirth**. Is that a yes or a no? I assume that that is, that we will have certification and that appropriate corrective actions have been implemented and have ascertained that it is safe to open.

Mr. **Tuck**. Well, I want to make a distinction. You have asked three separate questions and I wish to give you three separate answers. This Department is not in a position to dictate to the Defense Nuclear Facilities Safety Board what it will or will not do. It is an independent agency. If it chooses to issue a certification to normalization of operations at Rocky Flats, so be it. But Admiral Watkins is not in a position to dictate to the Defense Nuclear Facilities Safety Board what it will or will not do.

Senator **Wirth**. I'm not suggesting that.

Mr. **Tuck**. It is a little stretched to say that Admiral Watkins can say with certainty that the Defense Nuclear Facilities Safety Board will certify. He is not in a position to direct their activity. He is certainly in a position to speak for himself, and he is in a position to speak somewhat with regard to his advisory committee.

Senator **Wirth**. Well, if his advisory committee said to him that this is not safe to open, would he go ahead and open it?

Mr. **Tuck**. Absolutely not. Of course not.

Senator **Wirth**. He would then go along with the statement made by Mr. Ahearne today, "it will take at least 6 months to solve the significant safety problems?"

Mr. **Tuck**. I am not aware that that was a statement made by John Ahearne. I take you at your word that such a statement was uttered. But it is not my understanding of Mr. Ahearne's observation.

Senator **Wirth**. Well, I was not there. I just have a quote from that meeting.

Mr. **Tuck**. It is not my understanding that that was Mr. Ahearne's observation.

Senator **Wirth**. If he were to have said that or the Commission were to say that it is not safe to open until January of 1991, or until mid-1991, or whenever, you wouldn't open until they said it was safe to open, is that correct?

Mr. **Tuck**. I think that's accurate. Yes, sir.

Senator **Wirth**. Okay. Thank you, Mr. Chairman.

Senator **Exon**. Thank you, Senator Wirth. Thank you gentlemen. We will now stand adjourned and will reconvene at 4:20 p.m. in room SR-222.

[Whereupon, at 4:09 p.m., the subcommittee recessed, to reconvene in executive session at the call of the Chair.]

HEARING RESUMED—EXECUTIVE SESSION

WEDNESDAY, MAY 23, 1990

U.S. SENATE,
SUBCOMMITTEE ON STRATEGIC FORCES
AND NUCLEAR DETERRENCE,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

DEPARTMENT OF ENERGY BUDGET REQUESTS

The subcommittee met, pursuant to recess, at 4:26 p.m., in room SR-222, Russell Senate Office Building, Senator J. James Exon, chairman of the subcommittee, presiding.

Committee members present: Senators Nunn (chairman), Exon, Levin, and Wirth.

Committee staff member present: Madelyn R. Creedon, counsel.

Professional staff members present: Robert E. Bayer; William E. Hoehn, Jr.; T. Kirk McConnell; and Michael J. McCord.

Minority staff member present: George W. Lauffer, professional staff member.

Staff assistants present: Cindy Pearson and Mickie Jan Wise.

Committee members' assistants present: Andrew W. Johnson, assistant to Senator Exon; Christopher E. Paine, assistant to Senator Kennedy; Edward M. McGaffigan, Jr., assistant to Senator Bingaman; and Robert M. Soofer, assistant to Senator Gorton.

Senator EXON. The subcommittee will please come to order. I would ask the Secretary to verify that the parties you have with you today are cleared with regard to the closed session. I would ask the staff to advise the Chair that those not accompanying the Secretary are also properly admitted to this closed session.

Secretary WATKINS. Mr. Chairman, I will certify that all of the Department of Energy individuals here are "Q" cleared for this hearing.

Madelyn CREEDON. I will certify that all of the Senate employees here are "Q" cleared for this hearing.

Senator EXON. Thank you.

OPENING STATEMENT OF SENATOR J. JAMES EXON, CHAIRMAN

Senator EXON. The Subcommittee on Strategic Forces and Nuclear Deterrence reconvenes in closed session to hear the testimony from Adm. James D. Watkins, Secretary of the Department of Energy. This is a closed session and attendance is restricted to those holding a Department of Energy "Q" clearance.

By way of following up our May 1 hearing, this subcommittee remains concerned about the failure of the Department to provide a detailed planning document to chart the Department's future and to assist this subcommittee in its work on the 1991 authorization bill. Quite simply, this is going to be a very tight year. For example, I can tell you now that there will be no funding from the Department of Defense budget to pass through the Department of Energy as there has been in past years.

Staff did receive an indication of what the Department's plans are for the future, albeit in abbreviated form only yesterday, but we appreciate that. I am just concerned that the Department is so far behind in the process. Any further guidance that you can give us in this area, Mr. Secretary, will be helpful and I think will pave the way for the continued good relationship that we have enjoyed with you and your Department.

Secretary WATKINS. If I may, Mr. Chairman, just in response to that, I met with Senator Nunn this morning and informed him that I would provide him a letter tomorrow that will map out the entire modernization strategy; also the 5-year plan strategy, Environmental Restoration and Waste Management, for near-term and long-term, and give you my best shot at the 5-year plan that we were unable to submit on February 15 of this year, as I indicated in the open hearing, by May 1. I think he felt it would be helpful.

The committee staff looked at the content of the informal document that I passed him, which would be an enclosure to a letter, and I think they feel all committee members would find that useful. So that is coming over tomorrow, to let you know exactly where we stand at this point in time on the 5-year plan, recognizing that we do not have budget quality documents and must go through the programmatic EIS and other EIS procedures under NEPA that will give us the real long-range plan. But we simply cannot come to grips with it right now. But I do believe we have reasonable budget projections and good data for 1991 decisionmaking at this time, and that should be over to the committee tomorrow.

Senator EXON. Thank you, Mr. Secretary. At this time, then, I would be glad to recognize you. I would like to have you fill us in on anything that you feel would be appropriate. I would especially invite you to elaborate on any matters raised in the May 1 hearing, to the extent you believe it would be helpful to this subcommittee. If you have any prepared statements, we would accept them, without objection, for the record at this time. I would ask you to summarize in any fashion you see fit, Mr. Secretary. Welcome.

STATEMENT OF HON. JAMES D. WATKINS, SECRETARY OF ENERGY; ACCOMPANIED BY JONN C. TUCK, UNDER SECRETARY OF ENERGY; REAR ADM. MICHAEL BARR, DEPUTY ASSISTANT SECRETARY OF ENERGY FOR MILITARY APPLICATION; DR. ALBERT NARATH, PRESIDENT, SANDIA NATIONAL LABORATORIES; DR. JOHN N. NUCKOLLS, DIRECTOR, LAWRENCE LIVERMORE LABORATORIES; AND DR. SIGFRIED S. HECKER, DIRECTOR, LOS ALAMOS NATIONAL LABORATORIES

TIGER TEAM ACTION PLANS

Secretary WATKINS. Thank you, Mr. Chairman. I promised you a list of revised dates for the Tiger Team Action Plans submitted for my review and approval, and my letters to Senator Glenn and other Members of Congress stated the current status of our plans. For the record, those dates are: Portsmouth, May 30; Fernald, June 11; Rocky Flats, June 20; Nevada Test Site, June 21; Savannah River, July 2; Pantex, July 13; Y-12 plant, July 20; Mound, August 9; and Kansas City, August 31.

I want to emphasize again, as I did during the May 1 hearing, that we are not waiting for those plans to be approved. We are addressing the critical items identified by the Tiger Team assessments that consist of over 60 action items that we can absorb within our current budget flexibility. In other words, all of the important action items are covered today.

On the other hand, I have to point out that implementation of the final action plans will have significant budget impacts. These are longer-range problems that we have to address. While the draft action plans will contain preliminary estimates of cost, the Department will have to review those requirements and determine the proper mix of funds, tradeoffs, and need for amended or supplemental requests. We will keep the committee informed during that process. But certainly for the 1992 budget submission, we should be well on our way to addressing all of the issues at the weapons facilities that I just outlined.

DESTINCTION BETWEEN INDEPENDENT OVERSIGHT COMMITTEES

I also wanted to clarify the role of the Defense Nuclear Facilities Safety Board and the Advisory Committee on Nuclear Facility Safety in the resumption of operations at Rocky Flats. We had considerable discussion on May 1, and I left feeling that the committee did not feel comfortable with the distinction made between those two committees and their role as independent oversight committees prior to start-up.

The Department, the Defense Nuclear Facilities Safety Board, and the Advisory Committee on Nuclear Facility Safety are reviewing the information provided by the contractor, EG&G, at Rocky Flats. All issues raised by either body will be resolved satisfactorily and action plans prepared prior to any final decision regarding start-up. This means that any item in there that is considered to be start-up relevant will be completed before start-up, and the necessary dates will be shifted accordingly in order to achieve that objective.

As you are aware, the Defense Nuclear Facilities Safety Board is independent and, as such, the Department cannot dictate when or what reviews will be accomplished with regard to any facility. On the other hand, I do expect the Advisory Committee on Nuclear Facility Safety will comment and provide advice to me on normalization of operations at Rocky Flats.

We are taking all of their actions. We have yet to find any objection to the actions they recommend and they are all being factored into our start-up plans. So it is a kind of continuing, evolutionary process, with new discoveries being factored in every day, and wheat from chaff being separated. By "wheat," I mean those that are necessary for start-up, such as the safety-related issues, or those in the lesser pile that go on to the longer-range fix. But all are being addressed and must be maintained in the data base of actions in order to satisfy those independent oversight committees.

Prior to resuming operations, the Department will conduct an on-site operational readiness review, as recommended by the Defense Nuclear Facilities Safety Board, after the contractor has established its readiness for operations. I expect to announce dates for this review in the next several weeks. That will be a very thorough and complete review by the Department, and the results of that will have to be presented to the Defense Nuclear Facilities Safety Board.

FUTURE OF ROCKY FLATS PLANT

The Department's position on future operations at Rocky Flats was addressed at the May 1 hearing. I want to make sure there is no misunderstanding of that position.

Several options under consideration in the modernization review of the nuclear weapons complex suggest close-out of operations at the Rocky Flats plant in the long-term. However, we must follow the decision process established in the National Environmental Policy Act (NEPA). As I have stated before, a notice of intent will be issued at the end of this year, and scoping hearings will be conducted in January 1991. Final determination will not be made until the record of decision from the programmatic environmental impact statement (EIS) is made in fiscal year 1994.

At this time, it is our preferred approach to phase out Rocky Flats operations in the long-term; but we will have to go through the programmatic EIS and look at all alternatives. In the meantime, the famous Building 371 is funded through Title II of the NEPA, which is permitted under the law, and says that we can go up to the point where bricks and mortar are used. We are not asking for dollars to take us beyond doing the design work for construction. We are not asking for any actual construction dollars in the budget at this time.

NUCLEAR WEAPON SAFETY

Finally, Secretary Cheney and I share equal concern for nuclear weapon safety. Both of us were briefed by the weapons laboratories directors on weapons safety issues. As a result of this meeting, the Weapons Safety Committee of the Nuclear Weapons Council was established as a senior level body dedicated to weapon safety. Rear Admiral Barr, the Energy Department's Deputy Assistant Secretary for Military Application, is with us today, and is the chairman of this important committee.

One of the requirements of the committee is to brief Secretary Cheney and myself on weapon safety issues and concerns. Both the Energy and Defense Departments report annually to the President on the status of the nuclear weapons surety, which include safety, security, and control. This has been done and addressed the items that were outlined in the newspaper article this morning.

We vigorously support stockpile modernization as a means of enhancing the overall safety of the stockpile, as well as laboratory initiatives to develop new safety technology, which can be incorporated into the stockpile in the future.

With those brief comments, Mr. Chairman, I will open myself up to any questions you may have.

Senator EXON. Thank you, Mr. Secretary. Let me first say, for the assistance of our recorder and for the accuracy of the record, that anyone who accompanies you and who is asked by you or any of the members of the committee to answer questions, that you be good enough to identify them so that the voices can appropriately match the official record.

Secretary **WATKINS**. Yes, sir, I will.

WEAPONS SAFETY—SRAM-A

Senator **EXON**. Thank you. Let me start out if I might, Mr. Secretary. I think you are fully aware of the fact that three distinguished directors of three of our leading laboratories testified this morning in this room in open session that the SRAM-A was enough of a safety hazard that they felt it would be wise to stockpile this weapon in storage, rather than having it on alert aircraft, as is the situation today. This was followed up on by questions that I asked Under Secretary Tuck in the meeting we just concluded. He advised that the process was now under review and, when pressed, indicated that he anticipated that the recommendation would be made shortly that the SRAM-A not be part of any onboard alert aircraft, but rather stored and in the event the Commander-in-Chief felt that in some future emergency it could be redeployed on aircraft.

[Deleted.]

Now, I only cite you that story because we received testimony today in open session that indicated how potentially serious the SRAM-A situation was. To the press just a few moments ago and always, I have just said "potential" or "probable." It's not something that is likely to blow up instantaneously without reason and cause a nuclear disaster. [Deleted.]

I am sure that you know about this. I am asking you specifically whether or not the concerns that are well known in the Department of Energy have been communicated to the Secretary of Defense.

Secretary **WATKINS**. Yes, sir. They have been communicated to the Secretary of Defense. We have taken a significant number of actions because of the SRAM-A situation.

[Deleted.]

Now, on the SRAM-A, that came to my attention just a year ago, about the time I took over. I brought the laboratory directors in because I wanted to make sure that I understood the issues surrounding the SRAM-A. Because of that, it led me to a meeting with Secretary Cheney and Deputy Secretary Atwood. We had a very good meeting with the senior members of the Nuclear Weapons Council, and immediately established the Weapons Safety Committee under the Nuclear Weapons Council, which not only reports to the Council but may report independently to the Secretaries of Defense and Energy. That has now been established and is underway.

In that process, I strongly urged them to look at the operational constraints that we could place on the SRAM-A and take whatever immediate steps were necessary, and what they came up with initially was to make sure that cartridge starts of the aircraft engines were no longer authorized—that was done—and also, that any aircraft engine starts were run with full fire protection on station. This was done. So, the risk of that particular kind of accident was very low.

The other risk is from, let's say, an in-bound or out-bound aircraft which could careen off a runway and fall into the B-52, for example, which carries the SRAM on it. That has not changed.

[Deleted.] That would significantly change the risk evaluation and probably make the SRAM-A acceptable as a device for the interim period, until we can replace SRAM-A with its follow-on.

[Deleted.]

Senator EXON. Mr. Secretary, how soon do you expect that the review process will come to a conclusion and there will be a specific recommendation as to what to and what not to do on the SRAM-A?

Secretary WATKINS. In June, sir, June of 1990. Next month, sir.

Senator EXON. In June, next month. Since I think time is of some essence here, is it the beginning of June, the end of June, or the middle of June? When?

Secretary WATKINS. It will be toward the end of June, I am informed, Mr. Chairman.

Senator EXON. Well, I have a major concern about that schedule and maybe we will get back to that a little bit later. Before I recognize Senator Levin, let me ask one other question, and make a request.

NUCLEAR MATERIALS REQUIREMENT

A continuing concern of this subcommittee is the accuracy with which the stockpile memorandum reflects the weapons and materiel needs. Admiral Watkins, we would like the Department to prepare a report on the implications of the START Treaty on the plutonium and the tritium requirements. We have never had that. We are just asking you at this time, could you commit the Department to preparing such a report and submit it to the subcommittee?

Secretary WATKINS. Yes, sir, I have. We have some preliminary work on that report. We have been following that fairly closely. We will give you a detailed report. Basically, it goes something like this, Mr. Chairman. The plutonium inventory will continue to grow with weapons grade plutonium that comes back and is returned from the various warheads that are contained in that START Treaty. That is the payment that we have for winning the deterrent war, in my opinion. That will build up the stockpile and is one of the reasons that underpinned my decision earlier this year to terminate the Special Isotope Separation Facility. I did not feel it was necessary under any of the projections that we could see. So that is one thing that will continue to build up. Depending on how the warhead destruction protocol is written will determine how we finally finish up and store the weapons grade plutonium over time.

[Deleted.]

On the other hand, we do retrieve out of the returning vessels. That will add to the tritium inventory. Depending on when this is done and how it is done under the final START agreement will assist in giving us some kind of flexibility in our system because we have only the Savannah River reactors for the tritium supply. So, hopefully, out of this return, you will see a growth in the tritium inventory. [Deleted.]

I think these are the kinds of considerations we need to come back to you eventually and open up. In fact, I have some graphs today that I would be willing to show you as to where we are today and what might be the kind of impact that we would have from the mining of the tritium coming back from those vehicles. But I think the best thing to do would be to give you a complete briefing on that because it is not going to be easy to convey that without charts and graphs, and specific warhead types, and adding up the tritium supplies to show you how it all balances out.

Senator EXON. I think in the interest of time, we need not go into that today. I think you have explained it well, without going into all of the details. The Chairman does not particularly care to see that, but if the other members of the committee do, we will take the time to do it. My time is up on the first round. Senator Levin.

WEAPONS SAFETY—SRAM-A

Senator LEVIN. Thank you, Mr. Chairman. You have just described to us that there is some risk in maintaining the SRAM-A on alert. But you have some doubt as to whether or not we should continue to do that, personal doubt as you phrased it, given the change in the world situation.

Mr. Tuck was quoted this morning in the Washington Post as saying that the desire to incorporate the insensitive high explosive, the IHE, was "a prime driver," I assume quoting, in the agency's development of a replacement for the SRAM-A.

[Deleted.]

I am just wondering, first of all, assuming Mr. Tuck was quoted accurately, whether or not you share that fear, that statement of his, that there is enough of a concern about this issue that it is a prime driver, that concern to replace the SRAM-A altogether.

Secretary WATKINS. I would like to ask Mr. Tuck to follow up now that we are in a classified hearing and to pick up from his comments so that I can understand it because I was not there, Senator. I am not really sure. I understood what the article said in the paper, but I would like to hear what Mr. Tuck would say now, in a closed hearing like this.

INSENSITIVE HIGH EXPLOSIVES

Mr. TUCK. What I am alluding to, Mr. Secretary and Senator Levin, is that it has been the general trend and direction of the Department to place weapons with insensitive high explosives in the inventory to supplant or take the place of older weapons, that is, to incorporate the more modern safety features that we know—insensitive high explosives, fire resistance, and the modern electrical features—in the newer weapons. That is what you have in the next follow-on SRAM, to replace the SRAM-A, those types of weapons safety features being added to supplant or take the place of the SRAM-A.

Senator LEVIN. Were you accurately quoted, that the specific desire to incorporate IHE was a prime driver in the modern day?

Mr. TUCK. I think what I am alluding to is the fact that it has been the trend, or the import, or the direction of the guidance from the Department to incorporate the best safety features available in the newer weapons, and that is what we are doing.

Senator LEVIN. Was it a prime driver?

Mr. TUCK. Yes, Senator Levin, that is the short answer to your question.

SRAM-A ALERT STATUS

Senator LEVIN. Well, that being the case, I am wondering, Admiral, whether or not you have shared your personal views that you have reflected in here this afternoon about the alert status of the SRAM-A publicly, whether you have shared that with the public.

Secretary WATKINS. No, I have not aired them publicly. I tried to keep that within the confines of the Nuclear Weapons Council, with Secretary Cheney, and the Security Adviser to the President.

It has also been provided in the Report to the President this year, that operational changes should be looked at, and are being looked at now to determine whether or not that additional operational steps that I mentioned earlier could be made. It would be my recommendation that it would be done. [Deleted.] Certainly, this would seem to me to be one very valid reason for this particular weapon system, to put the SRAM-A in a safer mode, so that the risk assessment is dropped significantly for that one particular accident that we have not covered yet.

TRITIUM REQUIREMENT

Senator LEVIN. I talked to Mr. Tuck earlier this afternoon about the tritium issue. Let me pick it up with you. I gather that if a START Treaty is signed, the inventory requirement will be reduced for tritium.

Secretary WATKINS. I will have to provide that in the report, that the Chairman wants to see exactly when that will happen. Obviously, the tritium requirement will change over time, Senator Levin. But I think we have a transitional mode that we have to look at very carefully to see how that actually factors in with the phase-out plan of the warheads and the recovery of the tritium and so forth.

Senator LEVIN. In any event, within the next few years there will be a reduction in the inventory requirement?

Secretary WATKINS. [Deleted.]

Senator LEVIN. You have indicated that the one new production reactor at Savannah would provide 100 percent of the tritium requirement with the current inventory. That is what you told us in a prior hearing.

Secretary WATKINS. Yes, 100 percent of goal now. [Deleted.]

Senator LEVIN. That being the case, since the START Treaty would reduce the inventory need, would you let us know for the record approximately what percentage will be supplied by Savannah? Will it be 120 percent, 140 percent, 160 percent, after you have looked at the START outline and gone through your assessment?

Secretary WATKINS. I will include in the report we send to you a note against that to say what that level would be against goal. [Deleted.] But, obviously, that is going to be a major consideration, as

START I gets negotiated and expectations for perhaps movement toward a START II begin to be talked about. So, by the time we finish our environmental impact statement in the fall of 1991, I would expect to have a reasonably good understanding of all the factors which can be packaged in one recommendation that we can make to Congress about tritium requirements for the future.

Senator LEVIN. These numbers are expected by the Chairman when? Within the next couple of weeks?

Secretary WATKINS. I will let you know by letter when I can get the total package up to you. I would say certainly within 2 to 3 weeks I ought to be able to do that.

Senator LEVIN. That will be great. Thank you very much.

Senator EXON. Thank you, Senator Levin. Senator Wirth.

ROCKY FLATS BUILDING 371 EIS

Senator WIRTH. Thank you very much. Thank you very much, Mr. Secretary. We had a good discussion with Secretary Tuck earlier today and I think we came full circle on these questions of timing. I have a series of questions which I am going to send down to you. We have been through all of that. While I have you sort of here in the family, let me ask you a question about this coming EIS. As I look at Rocky Flats—and I will just be very honest about all of this—it seems to me that the problems surrounding Rocky Flats are probably going to get worse before they get better. It would be my hunch that, no matter what EG&G does or how carefully we do it, the perceptions and the sense of Rocky Flats and Rocky Flats' mission within the metropolitan area are going to get worse. That is just from reading and listening to the media. That's my best guess. I represented that congressional district for a dozen years down there and have a sense of the momentum.

As you all are looking at developing a plutonium reprocessing plant for which you are doing the EIS, or beginning the process of that EIS, that is all targeted, right, at building that facility at Rocky Flats, even though part of the EIS will be to look at alternative sites?

Secretary WATKINS. Yes, sir.

Senator WIRTH. But the planning that you are kicking off assumes that you are going to build on to an existing building at Rocky Flats, rather than build a free-standing building, and the drawings and work that you are going to do, I think.

Secretary WATKINS. We are not building anything onto 371, if that is what you are talking about.

Senator WIRTH. Isn't it the case that the drawings that the engineering will build off of, it's not going to be a free-standing building? Is that correct?

Secretary WATKINS. The addition is to 371 itself. So that is what I consider to be 371. So I was not sure what we are talking about.

Senator WIRTH. It is not a free-standing new building? The $600 million that is being requested is not going to be for a free-standing building?

Secretary WATKINS. No. It is the initially flawed and now required to be upgraded Building 371.

Senator **Wirth**. I see. So the engineering that will begin presumably in the not-distant future, engineering drawings on this will begin when?

Secretary **Watkins**. Engineering drawings are what we are asking for, up through Title II, so that we stay within the NEPA documentation. The NEPA permits that, to move out in that direction, up to that point, and does not allow you to start construction of the additional facilities until such time as that is completed, which will be some time from now.

Senator **Wirth**. Well, let me ask this question. If the environmental impact statement comes back and the analysis says well, you shouldn't put this building at Rocky Flats, let's assume that you are looking at alternatives. That's one of the things that the Admiral and I discussed yesterday, that you are going to be looking not only at Rocky Flats but at alternative sites. Let's say the analysis comes back and says do it at alternative sites, or at an alternative site. The engineering that will have been done at the Rocky Flats site will have gone for naught, isn't that correct?

Secretary **Watkins**. Yes, I think that is correct. But that is the risk that we take on every single programmatic EIS that we do, and we did the same thing out at Lawrence Livermore on the Special Isotope Separation. So I don't see why we should change our procedures when we have every judgment that we have brought to bear on that particular building of the studies that we have and all run indicate that that as the most optimum, and the alternatives are going to be extremely expensive, and we should move out in a direction not in series, to wait until we get through a very long process, when we have a requirement and expectation. And sure, we are in a sense meeting it, to that extent.

Senator **Wirth**. I am trying to offer a suggestion that if it were to turn out that in going down the EIS path, the decision gets made not to put this building at Rocky Flats, that decision—when is the EIS going to be completed?

Secretary **Watkins**. In about 18 months, I would think, on that building.

Senator **Wirth**. So you will be 18 months down the line with engineering drawings on 371. The suggestion is, does it make sense to draw this building as if it were to be an independent, free-standing building, so that the work that goes in could be applied any place? Do you see what I mean? I mean, say the EIS were to say that it doesn't go to Rocky Flats, it should go someplace else.

Secretary **Watkins**. Well, of course, we have done a lot of work in that regard, Senator Wirth, and we tried to tell you in the letter that we sent back up here on that particular building that when you buy into putting it elsewhere—and that will come out in the EIS—you buy into a whole host of new problems that will even delay it more, such as the transportation.

We have no transportation right now for that material to be moved out of there and processed somewhere else. That will have to be renegotiated in some way. That will be very complex. We have a siting problem. We will have to go through the entire siting issue again. So, it is a burden which will come out in the EIS and be adequately explained.

But our best judgments are today, that this is the most logical of the sites to put the money into now, so that we don't run in series with these decisions, and that we get on with what we think is an urgent requirement to process plutonium both for waste management, for special nuclear material recovery, and reentry into stockpile modernization.

Senator Wirth. Okay. Leaving aside the question of urgency, obviously I am not making myself clear. Were you to go through the EIS statement process and were the conclusion at the end of the process to be that Rocky Flats is not the optimal site for this, leaving aside all of the other issues that you raised, would it be prudent to develop your engineering and to configure the building in such a way that it would be a free-standing building, not dependent just on that site, at Rocky Flats, but would it be prudent to have that designed in such a way that it could go anywhere? I mean, say the EIS says it shouldn't go to Rocky Flats, but it should go anywhere else.

Secretary Watkins. I'm not sure how the input of that design is going to come out. Any design we have that's good for Rocky Flats will be good for someplace else.

Senator Wirth. But it can't be because it is configured to be built right onto the old Building 371. I am trying to offer a constructive question, to say that if it ends up that you are not going to Rocky Flats, why do engineering work that is exclusively directed at Rocky Flats? Might not it be a good idea to do that engineering work as if the building could be at a variety of places?

Secretary Watkins. Senator, if it turns out that it is not suitable at Rocky Flats under the EIS, we have bigger problems that are going to take more time than other EJSs, and we will have plenty of time to modify those drawings for a single, free-standing building elsewhere. So I don't think that is a problem right now.

Senator Wirth. That, then, is an answer, that if it does not go to Rocky Flats, it's going to be a long time for it to be someplace else.

Secretary Watkins. We have many other problems to face in that whole set of complex issues that are going to, I am afraid, take more time than the redesign of a free-standing building, which can probably be done very quickly from the design drawings that we have.

Senator Wirth. Of course, this begs the question. If there is already a reprocessing plant at Savannah River, there is a capability there that we were talking about yesterday. There is some capability at Los Alamos, but a good deal more at Savannah River. Why are we designing a building that is unique to Rocky Flats if, in fact, there is a capability at Savannah River? I am sure we will have a chance to get into this in greater detail. Thank you, Mr. Chairman.

WEAPON SAFETY

Senator Exon. Thank you, Senator Wirth. Mr. Secretary, let me ask this question and maybe we could call the three lab directors up to the table. I want to thank them for their courtesy in staying over for this hearing because we felt it was appropriate to close things off this morning in the open session. So let me direct this question to the three lab directors as a follow-on to what we were talking about this morning.

This morning we discussed the 8-inch artillery shell, the SRAM-A warhead, and the Trident II warhead. After your answers to my SRAM-A questions, I was almost afraid to ask in open session whether there are other weapons that have important or significant safety problems. Now that we are here in closed session, let me ask, are there more problems and how many more? Do they compare in seriousness? If so, to what degree with the testimony this morning on the SRAM?

Dr. NARATH. I am Al Narath, from Sandia. The question of safety of older weapon systems has been examined from time to time. Most recently, just a few weeks ago, the answer has always come out the same, to my knowledge, namely the systems we identified this morning are, indeed, the ones of most significant concern. The others, among the older weapons, while still not meeting modern standards, both in terms of their design features as well as the exposure they suffer in current deployment, do not rank nearly as high in concern as what we discussed this morning.

Dr. HECKER. I am Sig Hecker. I would like to make a comment also. Certainly, as Dr. Narath pointed out, we have done the studies and they have identified a number of systems. [Deleted.] However, I would beg to differ that the W-88, which was mentioned this morning, was very far down the list from a standpoint of our overall concerns. So I would personally not rank that in the top level of concern. However, one of the other issues that we have always been concerned about is the question of transportation of nuclear weapons in addition to the specific weapons, and especially transportation of systems that do not have this insensitive high explosive.

Dr. NARATH. Just for the record, I agree with Sig Hecker. I spoke carelessly. [Deleted.] I agree that the W-88 is not the problem.

Dr. NUCKOLLS. An important number that we should have given you this morning, when you started talking about an 85 percent to 95 percent confidence level, is the number that we have identified tentatively with the W-88, which is 10 to the minus 6. We were not quite sure whether we should say that in open session. Perhaps we should have.

[Deleted.]

Senator EXON. Can you elaborate a little bit further on the shocked look I saw on your faces this morning when I asked you, if 100 were perfect, how we would rate this? I can understand your hesitancy in open session, because if you had said 92 percent, the headlines in the morning paper would be that it's only 92 percent safe, and so forth and so on. But now, in closed session, I think you recognize what I was trying to get at. We want to have some kind of understanding. Could any of you be a little more forthcoming than you were this morning with regard to if 100 is the safest of the safe, where these other systems would fall in potential danger?

Dr. HECKER. Senator, let me try to tackle the question that you asked this morning. It was directed I think more at me because it was in relation to the W-88. What you asked is if you take insensitive high explosive and you would substitute it, how would you change the safety, on a scale of zero to 100. It was that change that

I could not quantify, although the part that needed to be emphasized is what John Nuckolls just said, that we are talking about a one in a million chance of a nuclear detonation associated with what let's say we call a one point accidental initiation of the conventional high explosive.

So the safety aspect is already one in a million. It is not one in a hundred, or 10 in a hundred; it is one in a million. So, if we substitute the insensitive high explosive, the difference is a small difference in this analysis of one in a million. So it was not possible to rate it in terms of 10 percent or 20 percent from zero to 100. You have to remember that we were looking at probabilities with one in a million.

PLUTONIUM SCATTER

Secretary **WATKINS**. But I think it might be important for the Director of Los Alamos to tell you what it does affect in terms of plutonium scatter potential. I think that is a little bit different than the nuclear yield, which we normally think about. This is because we are also interested in not having, let's say a fire or something of that nature, with a detonation that could give us a plutonium scatter. So in that sense, there may be reduced risk. I don't know. I would like for Dr. Hecker to answer that.

Senator **EXON**. That is a good question. What is the answer please, Dr. Hecker?

Dr. **HECKER**. When those studies were made in the early 1980s and then really all through the 1980s, as the different accident scenarios were looked at, there was not a significant difference in plutonium scatter for the routine environment that this particular warhead and the missile would see. The major concern which we did have was that if this weapon, the warhead, would be air-transported to its site. And so, as part of our overall stipulations, we said that this warhead should not be air-transported. That is where the potential for plutonium scatter would come from.

All other scenarios are sufficiently benign so that there is not a significant difference between the insensitive high explosive and the conventional explosive. There is, in addition, the complication with the rocket motor fuel that is part of the third stage, which is also quite sensitive. Again, if you take that into account, there just is not enough difference between insensitive explosive in the warhead and conventional explosive.

AIR TRANSPORTATION OF NUCLEAR WEAPONS

Secretary **WATKINS**. The reason I bring this up is because we are looking at air transport of these weapons now, as a part of this review. It has been a very big issue within the Nuclear Weapons Council, and it continues to be. We will continue to look at that. We are very concerned about moving weapons of the older kind anywhere by air. And yet, we have to do it by helicopter, which is a worrisome thing for all of us. Special precautions are taken, of course, but an accident is still a probability and we have to deal with it. So I bring it up in that context.

Senator **EXON**. Thank you, gentlemen. Senator Nunn.

WEAPON SAFETY

Senator **Nunn**. Mr. Chairman, I don't want to rehash what you have already been over. So if I ask a question that you have already asked, please let me know. I understand the testimony this morning addressed this issue, but let me see if I understand it correctly. The newspaper article today in the Washington Post mentioned the W-88 warhead, which is the Trident II warhead, is that correct?

Secretary **Watkins**. Yes, sir.

Senator **Nunn**. I understand that the panel talked a little bit this morning about that particular article. The article basically said that that warhead had some real dangers to it. Would you each address that?

Senator **Exon**. Senator Nunn, we have gone through that several times. I don't believe that that is the exact description. Let me enter it in layman's terms and you correct it in technical terms. I believe that what we talked about this morning and expanded on again in the open session this afternoon was that there was no significant concern expressed by the three directors of the labs with regard to the W-88 warhead. However, they testified that with new innovation and some new steps that are coming along, they felt that they could improve minor concerns that they have with regard to the W-88. Is that a fair layman's statement of what you testified to?

Dr. **Narath**. Yes, sir.

Dr. **Nuckolls**. Yes, sir.

Senator **Exon**. So I didn't believe, Senator Nunn, or at least I did not sense this morning that there was any concern here, as opposed to the outright concern on [deleted] the SRAM, with regard to the W-88.

Senator **Nunn**. I guess it's just a question of time before I'm going to be asked a question from people back at King's Bay where the Trident is located. What can I tell them? I guess that is what I'm asking. Admiral, what would you say?

Secretary **Watkins**. In my opinion, the answer would be that we have reviewed all aspects of the W-88; that it meets all of our current safety requirements; that there is always an effort by us to enhance the safety of every weapon when we can, even beyond that which meets the minimal safety specifications. That is what we intend to do as we continue our studies on the W-88, as we move toward, perhaps, some insensitive high explosive relationship with the W-88 at some time in the future. Those studies are underway now, and we continue always, as we look back with new technologies, to analyze, to do the accident analyses on these weapons.

We are always going to come up with new a discovery. Every time we do, if we find out that it is serious, [deleted] we'll fix it immediately. We'll do what is necessary to make it safe and then to find mechanisms to put it back on duty if it can be done safely. If we find out that there is some other fix that we ought to put in over time, we'll put that in the modernization of the stockpile program, and that is our intent here, to see what we should do with the W-88 as the laboratories continue to do their modeling.

It may well be that the so-called area scenario, instead of a point scenario, can somehow be postulated as a legitimate scenario, and I believe the labs ought to comment on that and tell you what they are continuing to do as they review the kinds of programming modeling that they are doing with their sophisticated computers and what they might want to do in terms of testing in the desert. But those are ongoing reviews on every single weapon. I mean, we are always involved in reviewing the safety, particularly of the older weapons, and the decisions that were made in the past to continue the upgrade, such as we are now doing with the SRAM-A, where operational fixes can be done in the near-term and we can put this into the normal stockpile modernization program, which, for that particular weapon, is not going to be completely replaced until [deleted]. I would like to have the directors follow up on that and say anything they want regarding that.

Senator NUNN. Let me ask the question in this way. The newspaper article says, and let me quote it, and then maybe you could comment on the newspaper article and say what part of it is accurate and what part is not: "some U.S. weapon scientists have alleged, based on computer modeling of accident scenarios, that the W-88 could be detonated accidentally if the propellant fuel in the D-5 missile catches fire due to mishandling during loading operations at the Trident bases in Bangor, Washington, and Kings Bay, Georgia. A powerful nuclear blast or widespread dispersal of cancer-causing plutonium dust would result, these scientists say. They add that in years past, the latter possibility has been taken so seriously that Livermore experts prepared maps of potential plutonium fallout over Spokane, Washington, near the Trident base in Bangor."

Secretary WATKINS. Well, we have the two experts here, one from Los Alamos and one from Lawrence Livermore. I would suggest that we start with Los Alamos and then shift to Livermore.

Senator NUNN. Okay.

Dr. HECKER. All of the modeling that we have done of potential accident scenarios so far indicates that that statement is not true. We have not been able to find a way, let's say by computers, to go ahead and detonate that material. It is still all done with the probability of the best that we can calculate at 10 to the minus 6.

When our new calculations for new capabilities that we have developed in the past few years and the new computational capabilities that we have, in terms of computer speed, made three dimensional analysis possible and indicated that there may be a problem, as was actually first indicated by Livermore, we did the calculations. We actually did an underground Nevada nuclear test shot to check our calculations and check this possibility. When the tests indicated that we did not have a one point safety problem, it seemed to corroborate our capabilities to calculate, and, again, we have not shown, calculationally, or with all the testing that we have been able to do so far, that there is a problem on the W-88.

Dr. NUCKOLLS. I would certainly agree with what Sig said. I think we are talking mainly about nuclear detonation.

Dr. HECKER. That's correct.

COMPUTER MODELING—PLUTONIUM SCATTER

Dr. **NUCKOLLS**. Now, for the plutonium scatter, you have to look at the probability of the whole system, given the scenarios that it is handled in. As I indicated earlier, that also comes out to be on the order of 10 to the minus 6 for a plutonium scatter accident. I mean, it's true that if you somehow set off the IHE on the nuclear warhead it would scatter plutonium over wherever it is. But the probability of that has been analyzed and has been estimated to be very small.

We are continuing to work with our new three dimensional computer models which we only recently have been able to apply to this problem. We have some people at the laboratory that are investigating various scenarios involving multi-point detonations. But I think it is very important not to respond every time somebody runs a new computer calculation. Until somebody goes out to the desert and gets a test that gives a definitive answer, I think it would not be a good thing to overreact.

Senator **NUNN**. What if a newspaper at Kings Bay called you and asked you to respond to this article? What would you say to them in public?

Dr. **NUCKOLLS**. We are trying to say as little as possible. [Laughter.]

Senator **NUNN**. That's right. But try doing that when you are running for office. [Laughter.]

Dr. **NUCKOLLS**. I think we would refer that to the Department of Energy. I don't know. I would ask the Secretary.

Secretary **WATKINS**. Well, I think you have an issue, Senator Nunn, and I think you need to be able to say that you have run this thing out with us and we have informed you to your satisfaction, or not to your satisfaction, that we have achieved the objectives in the weapons stockpile safety, the very thing that we talked about here. You can't use 10 to the minus 6. But you are hearing here that 10 to the minus 6 has not been violated, with the best information that we have today, with the best tests that we've run and the best modeling, in either the plutonium scatter or the nuclear detonation.

Senator **NUNN**. So that says that the acceptable standard is being met? Is that what 10 to the minus 6 means?

Secretary **WATKINS**. Yes, sir, it does, and the single point, the one point safety issue, that is included in that comment.

This group here is saying that we currently meet all of our stated requirements for stockpile safety in the W-88. We may find a year from now that they are going to come up with a sophisticated model in which this multi-point detonation has some legitimacy, in terms of the scenario, the accident scenario, that they can postulate. I think they are working on that right now.

So we are not saying forever that this is it. Just as we found [deleted] when you begin to look back with new modeling techniques on old weapons, you find out that we have to do some things in some cases to fix them and get them back into the parameters of the stockpile safety requirements.

Senator **NUNN**. Thank you, Mr. Chairman. Thank you, gentlemen.

ROCKY FLATS—WEAPON PRODUCTION

Senator EXON. Thank you very much. I just have one more question and then there will be additional questions, I am sure, for the record, to which we would appreciate your responding as quickly as possible. Back to Rocky Flats one more time. Rocky Flats has been shut down now since the end of 1989 or thereabouts. Will the Department of Energy be able to meet its production goals if Rocky Flats resumes production in August? I suspect the answer to that is yes. Is that correct?

Secretary WATKINS. [Deleted.]

Now, that stockpile memorandum is constantly under review. You saw Follow-On To Lance removed from the equation. You have seen a number of changes. So we are constantly going through that review with the Department of Defense.

We are now up to the stockpile memorandum called 89-8, and that is the one we are working with. It could well change over time as new things unfold. [Deleted.]

Senator EXON. I understand.

Secretary WATKINS. And we have negotiated these warheads, their priorities, with the Department of Defense as part of the Nuclear Weapons Council responsibility to give us their best priority under those circumstances.

Senator EXON. Can you tell us what those priorities are now? [Deleted.]

Secretary WATKINS. If you would just hold on a second, Mr. Chairman, I think I have some notes here that will talk a little bit about that. This is Admiral Barr, my Deputy Assistant Secretary for Military Application.

Senator EXON. Thank you, Mr. Secretary. Admiral, welcome.

Admiral BARR. Thank you, sir. [Deleted.]

Senator EXON. [Deleted.]

Admiral BARR. [Deleted.] I hope that answers your question.

Senator EXON. Yes, I think that answers the question very well. We appreciate your forthcoming answers.

Gentlemen, I have no further questions. Is there anything that any of you would like to add? If not, thank you for being here and thank you for being so informative. Is there anything you want to add, Mr. Secretary?

WEAPON SAFETY

Secretary WATKINS. I would only like to say, Mr. Chairman, that the article that was in the paper today has been under preparation by the author for some time. Where he gets that information, I have no idea. The recommendation to me was that I meet with him the day before yesterday because of [deleted]. The worrisome thing I had in my own mind was to raise the fear and apprehension of the American people and our allies that we were not on top of the safety issue. I would like to talk to him and give him the balanced picture, that we are on top of it, that we are worried about safety.

These three (indicating) have gotten me sparked into action a year ago, and we moved aggressively to go after [deleted] the SRAM-A issue, a complete modernization of our report to the President, which both Dick Cheney and I agreed needed to be strengthened. It needed to be tighter. We needed to make sure the President really understood what the problem was with the SRAM-A. We did that. It took some time to negotiate all of that. But it was done and it was reported to the President properly by General Scowcroft. I have positive information on that and I know exactly what was presented to the President. It was a good, clean presentation on all the issues that were in the paper today.

[Deleted.] We are not hiding anything.

The difficulty of this is dealing with it in the uncleared atmosphere, because of the very things that we talked about here, such as 10 to the minus 6. People don't understand all of that and is one in a million a good enough type of thing. So I think we understand it within the committees and within the executive branch. I hope that we tended to send a signal out there that I think we are on top of this issue. I really do. I know that the laboratory directors are sensitive to these issues and they move expeditiously to inform us of any new discovery and findings on these weapons.

[Deleted.] I will have to admit that I come down on the side that I think that can be changed and very quickly.

Senator EXON. Thank you very much. Obviously you would have killed the story and I think that is not what the reporter was after. That's why he probably didn't want to get into this with you.

I also asked staff just what did 10 to the minus 6 mean. My staff tells me that that means one chance in a million. That is a misnomer, because 10 to the minus 6, or one chance in a million, is what I refer to as the chance of balancing the budget. So you are going to have to come up with a little different figure before I can apply that. [Laughter.]

Senator EXON. I think we have a better chance of solving the problems that you are wrestling with than we do of balancing the budget.

Secretary WATKINS. I agree with you, Mr. Chairman.

Senator EXON. Thank you very much. We are adjourned.

[Questions for the record with answers supplied follow:]

QUESTIONS SUBMITTED BY SENATOR EDWARD M. KENNEDY

MULTIPLE USE STUDY

Senator KENNEDY. Your Department has stated that it is preparing a "Multiple Use Study" which evaluates the repackaging, remanufacture, and reuse of existing warheads or nuclear warhead components. Has the study been completed? If so, please provide a copy to the committee.

Secretary WATKINS. The "Multiple Use Study" refers to our initial efforts to address issues relating to repackaging, remanufacture, and reuse of existing warheads or warhead components. The study was not completed because the efforts were redirected to the study of remanufacture and substitution of alternate warheads called for by the Nuclear Test Ban Readiness Program (NTBRP) established in section 1436 of the National Defense Authorization Act of 1989. A progress report on that activity was provided in the 1989 Annual Report to Congress. A study on the remanufacture of six representative warhead designs is expected to be completed this fall and will be submitted to Congress.

Senator KENNEDY. If the Rocky Flats Plant were to remain shut down for an extended period of time, what findings from the Multiple Use Study could be implemented to make do without a pit refabrication capability?

Secretary WATKINS. Multiple use of components is most successful when all the applications are similar and their requirements are included in the original design developments and testing program, otherwise modifications are generally necessary.

The nuclear weapon design laboratories are examining the reuse of pits from certain weapons being retired from the national stockpile.

[Deleted.] The laboratory studies are incomplete but are being actively pursued. Additional redesign development and nuclear tests will be necessary to evaluate the feasibility of these approaches.

NUCLEAR WEAPON REMANUFACTURE STUDY

Senator **Kennedy**. When will the committee receive the nuclear weapon remanufacture study requested in the committee's fiscal year 1990 report?

Secretary **Watkins**. The Department of Energy intends to meet the February 1, 1991, date as given in S. 2889. The Department has had an ongoing study addressing the remanufacture of six representative warheads which it is currently using as the basis for expansion to provide the greater detail desired by the committee. The Deputy Assistant Secretary for Military Application has tasked the appropriate field organizations to research the study areas stipulated by the committee to the maximum extent feasible and to combine that effort with the experience and insight gained from the earlier effort and other pertinent activities in order to meet the deadline provided.

ROCKY FLATS PLANT

Senator **Kennedy**. The Department of Energy appears to be backing away from its earlier decision to relocate Rocky Flats beginning in the mid 1990s. When will a final decision be made on whether to seek, via the EIS process, a new location for Rocky Flats plutonium processing and fabrication operations?

Secretary **Watkins**. On September 29, 1989, Secretary Watkins established the Modernization Review Committee to take a hard relook at the "2010 Report." The committee is reviewing the assumptions that underlie the report, including a look at the serious problems that have been identified since the report was prepared.

On January 12, 1990, Secretary Watkins announced that Department of Energy will prepare a programmatic environmental impact statement (PEIS) on the modernization program. The notice of intent is scheduled to be published in the *Federal Register* later this year. In addition to the "no action" alternative to assess the impacts of maintaining current complex operations and configuration, two fundamental reconfiguration options will be considered: Option A - upgrade, replace, and/or consolidate current facilities at their current sites, using existing support facilities and infrastructure as much as possible; and Option B - maximum consolidation which would consolidate much of the nuclear material production and manufacturing at a single site. The relocation of the functions performed at the Rocky Flats Plant will be considered under both options in an effort to reduce the number of individual operating sites. The decision on whether to relocate the Rocky Flats activity must be held open until the record of decision is rendered at the conclusion of the PEIS process.

Senator **Kennedy**. The Department of Energy's 2010 Modernization Study was completed in December 1988. Why has the Department of Energy delayed another 18 months before initiating the EIS selection process for a new site for Rocky Flats operations?

Secretary **Watkins**. While the study indicated the need for a number of specific major improvements over the next 20 years, it did not adequately address some of the serious problems that have since been identified, particularly with respect to environmental and waste management issues. Based on Secretary Watkins' review of the "2010 Report" and his dissatisfaction with some of the underlying assumptions, he established a committee, chaired by the Under Secretary, to closely reexamine the whole issue.

In January 1990, Secretary Watkins announced the preparation of two major environmental impact statements on key policy initiatives under development at the Department of Energy. These programmatic environmental impact statements will consider: (1) environmental consequences of implementing the Department's initiatives related to environmental restoration and waste management; and (2) the reconfiguration of the nuclear weapons complex.

The notice of intent for both PEISs are scheduled to be published in the *Federal Register* later this year. A determination regarding the relocation of the Rocky Flats Plant will be addressed in the PEIS for the nuclear weapons complex (see also response to prior question).

PRMP

Senator KENNEDY. Now the Department of Energy is proposing a $700 million Plutonium Recovery Modification Project (PRMP) for Building 371 at Rocky Flats. Why should the committee approve funds for this project without knowing the options for constructing a freestanding building of similar design at other sites already used for plutonium processing, such as the Savannah River plant?

Secretary WATKINS. The Department already has examined the cost of building a freestanding processing building of similar design. The estimated cost of that building is relatively insensitive to its location, be it Savannah River, Rocky Flats, or Idaho. The expected cost of a new freestanding building is approximately $1.1 billion, excluding moving costs and support costs. Therefore it is approximately twice the cost of a PRMP building. This issue will be addressed in the environmental impact statement for the PRMP.

Senator KENNEDY. Why would construction of the PRMP at an alternate location be any more burdensome from the EIS standpoint than construction at Rocky Flats?

Secretary WATKINS. The preparation for an EIS would not be significantly more burdensome, however the process of determining a suitable site would add 3 to 5 years to the process of constructing the building. That delay would be considered significant and a decision for siting might have to wait for the complex-wide, programmatic EIS, which is not due to be complete until 1994.

Senator KENNEDY. Why should the committee commit funds to the construction of the PRMP without knowing the timetable for phase-out of plutonium processing and pit fabrication operations at Rocky Flats?

Secretary WATKINS. The PRMP is not dependent upon the timetable for phaseout of Rocky Flats operations. Phase-out of operations would take up to 20 years or more because of the complex requirements of siting studies, EIS preparation, and then design, construction, and start-up. The PRMP would be in operation for up to 13 years prior to cessation of operations at Rocky Flats, and then could be used to facilitate the decommissioning of the site for several more years.

Senator KENNEDY. Your Department has stated that, as an alternative to the PRMP, the continued operation of Buildings 771 and 776 at Rocky Flats along with facilities at other sites is not viable because the cost would be too high and these facilities would not be able to produce the required amounts of material. However, the PRMP is not expected to be completed until 1997, at the earliest. Thus, for at least the next 6 years, the Department of Energy will actually be relying on the alternative it claims is inadequate. What improvements will the Department of Energy be making to the existing facilities in order for them to operate safely until the PRMP is completed, what will they cost, and when will they be implemented?

Secretary WATKINS. Prudent upgrades to existing facilities are being made all the time, and include safety items, security upgrades, ventilation and safeguards modifications, as well as replacement of older equipment with modernized equipment where possible. However, space limitations prevent a complete and significant upgrade. This is why Building 371 was constructed originally, to replace existing Buildings 771 and 776. Costs of upgrades to these two buildings over the next 5 years are approximately $88 million. The Department has stated that the existing facilities do not meet current standards for design basis accident and upgraded safety requirements. The estimated cost to modify the present buildings to full safety standards is approximately $1.1 billion, or twice that of the PRMP. In addition, the existing buildings are barely able to keep up with current residue production, and are unable to reduce the existing 140 tons of backlog that are stored on the site. Until the PRMP is complete, the Department has no choice but to utilize all of its capabilities to meet plutonium demands.

Senator KENNEDY. Should not this cost be added to the cost of the PRMP to fairly compare it to the other options, such as moving operations elsewhere as soon as possible? Please supply this cost comparison for the record.

Secretary WATKINS. Some upgrading of the existing buildings must be done, whether the PRMP is constructed or not, because the existing facilities must continue to run. The Department is spending approximately $18 million in capital costs per year to keep the existing plutonium facilities safe and operational. Comparable costs for the PRMP would be only about $7 million per year because it would be a new facility, with only minor maintenance required for many years.

Senator KENNEDY. When outlining options that are available other than building the PRMP, the Department of Energy distinguishes between (1) using Buildings 771 and 776, along with other facilities at Savannah River and Los Alamos; and (2) building the PRMP. But are not these both different parts of one option? Will not option (1) have to be carried out until option (2), the PRMP, is operational at the end of the century?

Secretary WATKINS. The Department will have to continue to use Buildings 771 and 776 as well as the other sites until the PRMP or a similar alternative is completed. The alternative considered was to modify and rebuild 771 and 776 in lieu of modifying Building 371. The estimated cost of that alternative was almost twice as much, and the time period required to modify was 3 to 5 years longer; moreover, processing operations would have to be shut down for several years while modification to the existing structures was accomplished.

Senator KENNEDY. How long would it take and how much would it cost, in fiscal year 1991 dollars, to relocate Rocky Flats operations (except D&D operations) before the year 2000? Please provide copies of Department of Energy studies of this question to the committee.

Secretary WATKINS. The Department believes it is not feasible, due to current requirements of the National Environmental Policy Act, to select a relocation site, design, construct, perform the necessary operational check-outs, and place into operation a facility to perform all the Rocky Flats operations prior to the year 2000.

NUCLEAR WARHEAD ASSEMBLY OPERATIONS

Senator KENNEDY. Which nuclear warhead assembly operations are continuing, and which have been interrupted, as a result of the shutdown at Rocky Flats?

Secretary WATKINS. The following nuclear weapons/warheads are continuing to be assembled with plutonium pits that were produced prior to the interruption of operations at Rocky Flats:

[Deleted.] If Rocky Flats does not resume operations, fiscal year 1991 production of the following weapons/warheads will be affected: [Deleted].

Senator KENNEDY. For those warhead assembly operations for which a backlog of plutonium components exist, how long will these inventories last?

Secretary WATKINS. Plutonium pit inventories will last [deleted].

WEAPONS COMPLEX

Senator KENNEDY. In light of the fact that options exist for continuing the scheduled deployment of Trident II missiles with W-76 rather than W-88 warheads and in light of recent safety concerns about the current conventional HE variant of the W-88, has the Department of Energy analyzed the option of lightening the load on the weapons complex by: canceling further W-88 production; deferring production until an IHE version of this warhead can be developed; or substituting the W-87 warhead, which already incorporates IHE?

Secretary WATKINS. The Department of Energy is concerned about the possibility of temporary W-88 production delays due to the suspension of operations at the Rocky Flats Plant but, at this time, is not considering either canceling further W-88 (Trident II) production or deferring production until an IHE version of this warhead can be developed. The W-87 (Peacekeeper) has not been considered as a substitute for the W-88 because the W-87 was not designed specifically for SSBN/SLBM employment and requires extensive analysis and testing to determine its suitability before a decision could be made. We understand from the Department of Defense that the Navy's preferred option to cover any short-term shortfall in W-88 production is to spread the available W-88 warheads among the first three deployed Trident II submarines. This would mean each submarine would deploy either with approximately 18 (out of 24) missiles or a full complement of missiles with fewer warheads on each. Another Navy option is to substitute W-76 (Trident I) warheads for W-88s.

PLUTONIUM PIT REFABRICATION

Senator KENNEDY. Assuming that a decision is made to upgrade warhead designs, such as the W-88, to use IHE, would the plutonium pits of these warheads have to be refabricated to accommodate the IHE? If so, what kind of recycle capacity would be necessary to deal with this activity?

Secretary WATKINS. If a decision is made to upgrade the W-88 to use IHE, the change will, almost invariably, require a new primary design. Incorporating this change into the stockpile would necessitate significant work involving plutonium components. The only facility in the United States with this manufacturing capability now is the Department of Energy plant at Rocky Flats, Colorado.

Senator KENNEDY. Is the W-61 Interim Earth Penetrator Weapon a simple modification of the B-61 bomb, or will new plutonium pit fabrication be required to produce this weapon?

Secretary WATKINS. The W-61 is a simple modification of the B-61 bomb. The W-61 warhead will be assembled from an existing B-61 bomb and additional components provided as a retrofit kit. New plutonium fabrication will *not* be necessary.

Senator KENNEDY. What is the major concern with older plutonium components, in terms of safety and performance?

Secretary WATKINS. One of the major concerns with the nuclear physics package in a weapons system is the aging effects on the plutonium and other critical materials. Our principal concern is with the continuing reliability and durability during the stockpile lifetime.

In older plutonium components we have experienced corrosion effects and changes in mechanical properties such as ductility and metallurgical microstructure. Newer alloys are being used in the new production of weapons components that mitigate these tendencies. The long-term performance impact of these changes is currently unknown, but provides an impetus for continual monitoring of aged materials for understanding and clues.

From a safety perspective, plutonium emits alpha particles which can react with low atomic weight impurities or nearby materials to produce neutrons. These can be a major contributor to radiation exposure for weapon handlers. The older components were constructed without the so-called "alpha barriers" that eliminate the production of neutrons from the alpha particles generated by normal plutonium decay. Also, the older components were designed with a different plutonium scattering standard than is currently desired. Incorporation of new materials to enhance the chances of plutonium containment in accident environments would require a change in the design of the plutonium components. Nuclear testing would be required to prove these new designs, and the fabrication of new components would be necessary to introduce the improvements into the stockpile.

Senator KENNEDY. Absent a requirement for a design change, is pit refabrication required based on safety and performance grounds alone?

Secretary WATKINS. From a strictly technical viewpoint, the Department of Energy has not had to refabricate pits due to changes or degradations in the plutonium component itself. However, changes in the criteria and standards for safety and performance have generated design changes that have led to pit refabrication requirements. The radiation reduction feature mentioned above and the addition of insensitive high explosive and additional plutonium containment features are examples.

Senator KENNEDY. How old does a weapon have to be before americium buildup in the warhead poses a safety hazard to personnel? Is this a uniform standard or does it vary by the amount of self shielding afforded by each individual design and its mode of deployment?

Secretary WATKINS. The Department of Energy specification for Am-241 in the fabrication of new components is 200 parts per million (ppm). This is based, in part, on changes in the metallurgical properties during stockpile lifetime and, in part, by the long-term personnel radiation exposure issue. The Am-241 content of the plutonium component increases at approximately the rate of 15 ppm per month and results in a gradual increase in both the gamma and neutron intrinsic radiation. Typically, the Department of Energy does not like to have weapons in the stockpile with more than 5,000 ppm (0.5 percent) in the plutonium components and would prefer to remove them somewhere between 2,000 and 5,000 ppm range. There is an exposure concern during the disassembly and recycle process when plant workers handle aged parts and reprocessing waste. This criterion translates into about a 20-year stockpile life.

The type and mode of deployment would define the level of hazard to which military personnel would be exposed. For instance, the tight quarters aboard a submarine would dictate a greater concern over the increase in radiation due to aging than in a weapons system where the warheads are stored in isolation, as in a missile silo. The standards for the plutonium components could be allowed to vary due to the deployment mode; however, the disassembly and recycle concerns would remain.

Senator KENNEDY. From the purely technical standpoint of weapon reliability, how long can plutonium components last before they have to be refabricated?

Secretary WATKINS. Technically, plutonium atoms can only change through their natural radioactive decay process. However, when fabricated into components, plutonium is a dynamic material that undergoes constant changes and will exhibit some practical performance lifetime. Currently, we do not have a complete understanding of these practical lifetime limits for such components. We do know that internal radiation damage occurs within the component and have identified helium gas buildup and microstructure degradations in moderately aged specimens. These observations do erode our confidence in the long-term performance of the components.

Our stockpile surveillance program has identified significant changes in the mechanical properties of plutonium components; one example being the demonstrated change of a factor of seven in the uniform plastic strain in 20-year-old samples taken from retired weapons components. We have also observed significant changes in the surface reactivity of old metal—another issue which could potentially cause performance degradation but is currently not fully characterized.

Based on experience with field components, we feel confident that we can guarantee performance of plutonium components that are adequately maintained for 15 to 20 years. However, we have also identified some problem areas in older metal which require further study before we can confidently extend any lifetime estimates.

QUESTIONS SUBMITTED BY SENATOR STROM THURMOND

UNDERGROUND NUCLEAR TESTS

Senator **THURMOND**. In a May 23, 1990, Washington Post article, it said that the W-79 problems were identified by computer simulation, but that they ". . . were confirmed by secret underground nuclear tests in December 1988 and February 1989." In light of this, is it not critical that we maintain the right to conduct underground tests as long as we rely on these systems for nuclear deterrence? In other words, isn't it necessary to conduct underground nuclear tests to confirm safety problems in addition to maintaining the reliability and modernization of our warheads?

Secretary **WATKINS**. As long as the United States national security strategy relies on nuclear deterrence, we must be free to conduct nuclear tests to ensure the credibility of our nuclear forces. Nuclear tests are required to not only maintain the reliability of the stockpile and support modernization but also to discover if defects/flaws relating to nuclear performance or safety exist and to confirm that modification or fixes are satisfactory.

NOTIFICATION

Senator **THURMOND**. Who in the German Government and in NATO was notified about the W-79 safety problem? When and what were they told about the problem?

Secretary **WATKINS**. Questions on this matter should be referred to the Department of Defense.

NEW PRODUCTION REACTOR

Senator **THURMOND**. The fiscal year 1991 request calls for $363 million for the New Production Reactor. What will this amount fund and what is the total funding projection for the NPR?

Secretary **WATKINS**. The fiscal year 1991 request of $363 million for the New Production Reactor Program includes $132.9 million for operating expenses, $221.3 million in construction (design) funds, and $8.8 million for capital equipment funds. This funding is essential to support the continued broad range of activities necessary to bring new production reactor capacity on-line, safely, with high production assurance and on a timely schedule. The fiscal year 1991 operating expenses request will fund confirmatory development activities to verifiscal year design and safety requirements for both the heavy water reactor and the modular high-temperature gas-cooled reactor; continued irradiation testing for LWR and MHTGR tritium target development in the advanced test reactor; continued implementation of the safety review process; preparation of the draft environmental impact statement; and program management. The construction funds requested in fiscal year 1991 will be used solely for continuation of Title I, preliminary design. No actual construction will take place during fiscal year 1991.

The only cost projections to date for the New Production Reactor Program are based on data provided by industrial proponents for the reactor technologies at the request of the ERAB in 1988. Better, budget-quality cost data will be available as contractor deliverables upon completion and review of the HWR and MHTGR conceptual designs. The accuracy of the cost projections will continue to improve as each phase of the design progresses. The proponent's preoperational and capital funding projection for the New Production Reactor Program is $6.9 billion in fiscal year 1988 dollars with an additional $0.1 billion needed for safety and environmental activities and program management.

Senator **Thurmond**. What is the preferred strategy that the Department is pursuing in acquiring new production reactor capacity? What is the current total estimated cost of this preferred strategy and what would be the cost by technology?

Secretary **Watkins**. The Department of Energy's preferred strategy for acquiring new production reactor capacity is to design and construct a heavy water reactor (HWR) at the Savannah River Site and to design and construct a modular high-temperature gas-cooled reactor plant (MHTGR) at the Idaho National Engineering Laboratory. As a contingency, work will continue on the development of a light water reactor (LWR) tritium target. The current total estimated cost of this strategy is $7.0 billion in 1988 dollars. This is the original cost estimate based upon proponent data. This estimate includes $3.2 billion for the HWR, $3.6 billion for the MHTGR, $0.1 billion for the LWR target development, and an additional $0.1 billion for safety and environmental compliance activities and program management. The accuracy of these proponent cost projections will continue to improve as each phase of the design progresses.

Senator **Thurmond**. Have any decisions been made regarding the selection of technologies and sites? If not, when will this be done?

Secretary **Watkins**. The Department is proceeding with the preferred strategy which was outlined in the August 8, 1988 Report to Congress. There has been no final decision made concerning the selection of technologies or sites for the new production reactors. This will be done at the record of decision which is scheduled for late 1991 following the completion of the environmental impact statement (EIS). The New Production Reactor Program is proceeding with the preparation of the EIS in parallel with confirmatory development and preliminary design. These actions will provide the Department with the necessary data to make sound choices about the final selection of technologies and sites at the record of decision.

Senator **Thurmond**. What is the benefit, in light of recent world events, of continuing to pursue the current preferred strategy until you reach the point of the record of decision in late 1991?

Secretary **Watkins**. Currently the United States is not producing tritium and the restart of the Savannah River Reactors offers an interim solution. Tritium is an essential ingredient for our modern nuclear weapons and has a radioactive half-life of 12.5 years. Therefore, tritium needs to be continually replaced to keep the Nation's nuclear deterrent viable. The Soviet Union still maintains a strong strategic capability. Thus, the Department's strategy centers around the issue of assured capacity. Currently, the record of decision is scheduled for late 1991. At that time, preliminary design and the environmental impact statement will have been completed. As a result, the Department will have more definitive cost and schedule data with which to make sound decisions as to the eventual selection of technologies and sites.

Questions Submitted by Senator Slade Gorton

UNIVERSITY GRANTS

Senator **Gorton**. I understand that the Department of Energy has awarded grants to a laboratory-university consortia in New Mexico and South Carolina to develop curriculum for training the technicians, scientists, and engineers to help solve the waste problems at the Department of Energy sites in these States. When can we expect the Department of Energy to make similar grants to laboratory-university consortia for similar efforts in Washington and Idaho—the States with challenges equal to or greater than those of other States?

Secretary **Watkins**. The Department is in the process of receiving applications for additional academic partnerships. On April 17, 1990, the Department of Energy issued a notice of program interest (NOPI) for "receiving unsolicited applications for assistance in innovative academic partnerships aimed at increasing the number of scientists, engineers, and other professionals, especially technicians, educated in relevant technical and non-technical disciplines to resolve the Nation's environmental restoration and waste management challenges." These applications will be evaluated on an objective basis which meets the Department's program requirements.

PUREX

Senator **Gorton**. How much is the amount of funding requested from the Environmental Restoration and Waste Management account in fiscal year 1991 for operation of the Hanford Purex Plant? Has the Department included operation of the Purex Plant as a "cleanup" operation under the Environmental Restoration and Waste Management account in the fiscal year 1991 budget request? If so, why?

Secretary WATKINS. Approximately $34 million has been earmarked in the fiscal year 1991 budget request under the Environmental Restoration and Waste Management account for managing the Purex and UO3 facilities and systems during the fourth quarter. Completion of the appropriate National Environmental Policy Act documentation will evaluate the various options for operating Purex or for decontamination and decommissioning of this facility. Responsibility for the operation of the Purex Plant is expected to transfer from the Office of Defense Programs to the Office of Environmental Restoration and Waste Management in the last quarter of fiscal 1991. This is in line with the transition of the Hanford Site mission from material production to waste management and cleanup.

BUDGET REQUESTS

Senator GORTON. Do you anticipate any shortfall between the amount requested in the President's budget request for fiscal year 1991 Hanford Environmental Restoration and RCRA compliance activities and the amount needed to meet all timeliness and milestones in the Hanford Federal Facility Agreement and Consent Order between the Department, the U.S. EPA, and the State of Washington?

Secretary WATKINS. In the first annual update of the Environmental Restoration and Waste Management Five-Year Plan, additional requirements over the budget request were identified for Hanford. A prioritized list of activities is being developed. Only the highest priority activities will be funded within the fiscal constraints of our fiscal year 1991 appropriations. If necessary, the Department of Energy will negotiate revised schedules with all parties concerned in order to comply with the agreements.

Senator GORTON. What percent of funds requested for the Environmental Restoration and Waste Management Account for fiscal year 1991 is actually proposed to be expended for meeting specific requirements for remedial investigation, feasibility studies, and remedial actions or corrective actions under CERCLA and RCRA?

Secretary WATKINS. Approximately 30 percent of the funds requested for the Environmental Restoration and Waste Management Program in fiscal year 1991 is being proposed to be expended for meeting specific requirements for remedial or corrective actions under CERCLA and RCRA.

[Whereupon, at 5:36 p.m., the subcommittee adjourned, to reconvene upon the call of the Chair.]

DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEAR 1991

THURSDAY, MAY 24, 1990

U.S. SENATE,
SUBCOMMITTEE ON STRATEGIC FORCES
AND NUCLEAR DETERRENCE,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

SPACE LAUNCH AND COMMAND, CONTROL, COMMUNICATIONS AND INTELLIGENCE PROGRAMS

The subcommittee met, pursuant to recess, at 3:26 p.m., in room S-407, The Capitol, Senator J. James Exon (chairman of the subcommittee) presiding.

Committee members present: Senators Exon and Wirth.

Staff members present: T. Kirk McConnell.

Minority staff members present: Brian D. Dailey, professional staff member.

Staff assistant present: Mickie Jan Wise.

Committee members' assistants present: Donald A. Mitchell, assistant to Senator Glenn.

OPENING STATEMENT OF SENATOR J. JAMES EXON, CHAIRMAN

Senator EXON. First let me request unanimous consent, that my opening statement be inserted in the record at the beginning of this panel's discussion. Without objection, so ordered.

I must leave for a short-period but I shall return. I ask that Senator Wirth preside in the meantime.

[The prepared statement of Senator Exon follows:]

PREPARED STATEMENT OF SENATOR J. JAMES EXON

The subcommittee will now come to order to-begin the second panel session of today's hearing. This session will focus on space launch programs and issues. We will be conducting this session at the secret level, and I would ask at this time for staff and our witnesses to confirm that all present are appropriately cleared.

As I indicated in my opening remarks for the first panel, a month ago, in the interest of time, Senator Thurmond and I sent advance questions to our principal witness for this panel, the Honorable Martin Faga, Assistant Secretary of the Air Force for Space. We had the pleasure of confirming Mr. Faga to his present position not many months ago, and it is a pleasure to have you here today. I am pleased also to report that Mr. Faga provided his answers to our questions in good time, for which we are grateful.

Without objection, the subcommittee's questions and Mr. Faga's responses shall be made part of the record.

Joining Mr. Faga is Brig. Gen. Don Hard, who is Director of Space and SDI Programs under the Assistant Secretary of the Air Force for Acquisition. Unfortunately, Mr. Welch, the Assistant Secretary, is in the Soviet Union, I believe, and will not be with us today. We welcome you Mr. Faga, and you General Hard.

The themes we shall pursue today are much the same as last year and the year before, and the year before that. The members of this committee are not happy with our space access capabilities. It just takes us too long to prepare a launch, it costs far too much, and it is an exceedingly complex affair. On the positive side of the ledger, DOD is actively considering a transfer of space launch operations to Space Command, as Mr. Faga noted in his statement.

On the negative side, budget pressures, and perhaps some unrealistic planning have conspired to shift the Advanced Launch System, or ALS, from an acquisition track to a track emphasizing only the development of technology for current and future launch systems. In other words, "business as usual."

We are obviously quite conscious of the severity of the budget crunch. At the same time, I do not see how we can tolerate business as usual in this area indefinitely. The trick is going to be to make progress at much lower cost than we had been expecting to bear. An 18 billion dollar investment in ALS, even if it would save us money over the long term, just isn't in the cards. I think we've got to get that down radically.

We'll get into these matters momentarily. Now, I would ask my colleague Senator Thurmond for his opening remarks.

[Advanced questions referred to follow:]

Advanced Questions for Space Launch Hearing

H.R. 2674

Question: Would you provide the Committee with your views on the Space Transportation Services Act introduced by Congressman Packard (H.R. 2674)? Is the Act consistent with the general direction in which the Commander-in-Chief of the Unified Space Command believes DoD's space launch operations should be headed? Is it true that "government specifications relating to vehicle design, construction, and operation" are a major factor in the current high cost of access to space as the Act alleges? What benefits does the space launch industry obtain from these "government specification?"

Response: I appreciate the opportunity to comment on the proposed H.R. 2674 and, in doing so, will address the related questions you have asked. While my answer is lengthy, it only serves to highlight the most significant concerns versus the totality of the proposed legislation.

H.R. 2674 is a well intentioned attempt to save money, place more responsibility and less oversight on industry, and foster a more competitive U.S. commercial expendable launch industry in the world marketplace. All are admirable goals which we support, and there may be a niche for this formulation under certain circumstances--specifically at the low end of the payload spectrum, but not across-the-board, as currently drafted. Unfortunately, we believe the assumptions underlying this approach are faulty and, in both the near and far terms, the provisions could result in adverse impacts to industry and government. In effect, it would hinder, rather than help, the advancement of commercial space activities.

Let me be more specific. It is not clear that commercial launch is "an essential component of national efforts to assure access to space," nor is there any analysis evident to support the contention that "commercial vehicles, not government vehicles, will be the most effective means to challenge foreign competition." Our assessments indicate that, at least into the turn of the century, U.S. government operational payloads will continue to be the primary market for U.S. launch providers. In the period 1990-1995, for example, government requirements for Delta vehicles are 68 percent; for Atlas: 76 percent; and for Titan: 87 percent. We believe those are relatively conservative estimates that are supported not just by Defense, but by the Departments of Transportation and Commerce, as well as the National Space Council. We project that our commercial launch industry is looking at an international market on the order of 15 payloads per year--where U.S. launch offerors may capture only 1-2 of those "competitions." Without subsidies or a true "level playing field," U.S. vendors likely face a difficult challenge in the world market.

Contrary to the H.R. 2674 view, Arianespace or those "companies" representing the PRC, USSR, or Japan are not true market competitors. Those launch industries are either highly subsidized or nationalized, and appear interested in establishing a launch industry regardless of price. An example is the recent bidding war over the future Arabsat payload among a U.S. firm, the PRC, and Ariane--where price was the bottom line and "profit" not part of the foreign equation. Such actions, where cost versus success rate is the key criterion, will make a sparse market for U.S. competitors. While maintaining a commercial business on that kind of anticipated return would be a real challenge in the mid to heavy range, that launch market for U.S.

providers can, and is, a profitable business when both government and commercial are factored.

Nevertheless, the most troubling aspects of H.R. 2674 are found in Section 5 and relate to the "Findings" (Section 2) that government specifications and oversight of industry pose an "unwarranted burden," and that, if eliminated, would "achieve substantial cost savings." Likewise, the Bill would mandate away requirements for industry-provided cost and pricing data, again, on the assumption that such measures significantly increase cost.

(Note that these provisions are similar to the current Title II of H.R. 4196, NASA Multi-Year Authorization Bill, as marked by the House Science, Space and Technology Subcommittee on Space Science and Applications on 9 March 1990.)

Our view is that reasonable levels of specifications and oversight are essential to both government and industry. Our discussions with industry people on this matter tend to confirm our beliefs--these measures help our industry to market its product more advantageously and aid in obtaining more favorable terms from the insurance industry. The commercial customer and the insurance companies know that a commercially purchased vehicle is virtually the same as the one contracted by the government. The key is that proper oversight/specifications are truly important--one needs only point to the recent commercial launch problems as examples. Likewise, some experts and senior commercial payload representatives are calling for more insight into the commercial launch process to ensure their investment. For DoD, in particular, incentives for reflight or insurance coverage are less that adequate assurance measures. Operational national security capabilities are essential to the country and cannot be left simply to subsequent reflight or booster insurance. Frequently, those DoD payloads are one-of-a-kind, multi-hundred million dollar assets where the launch vehicle cost is essentially on the margin when compared to the payload cost and the mission it is intended to perform. Also, since government typically self-indemnifies these launches and is responsible for success and safety, we believe it is necessary and prudent, as stewards of the taxpayers investment, that we have confidence that the launch vehicles will perform as expected. Reflight guarantees do not protect the satellite investment, nor can satellite insurance serve as an adequate substitute for operational capability. Our perspective is based on more than 30 years experience; that level of involvement also permits us to share extensive knowledge and experience among the range of industry providers without compromising individual proprietary data--another advantage that would not be permissible without insight into the process, as H.R. 2674 would eliminate.

We have found that quality, redundancy, and participation in the range of launch-related measures substantially reduce risk, and tend to minimize rating profits and schedule over mission success. This course does not mean we are unwilling, wherever possible, to tailor government specifications and oversight--to procure in a "commercially reasonable manner." Recent examples include the Delta II and Atlas II procurements where negotiated standards and arrangements have worked well. Among those provisions that mutually support government-industry commercial-like practices in DoD acquisitions are:

-- contractor control of configuration and production lines (reduces government in-line decisions/approvals);

-- tailored specifications (increases flexibility for parts/assemblies between government/non-government vehicles);

-- common production lines and, especially, volume procurements (increases focus on performance of end item versus government control over stock inventories--reduces inventory costs);

-- reduced levels of government oversight, e.g., monitoring systems and processes versus part-by-part inspections, and

-- monitoring service-to-performance criteria versus detailed systems level tests to specification (reduces administrative burden).

Nevertheless, commercial-like practices cannot be a panacea across the board. For the Atlas and Delta procurements, tailored practices were possible because of the low risk in using experienced contractors, and the assessed low-to-moderate risk in areas such as schedule, cost, support, and technical accountability. Despite the acceptable risk, the government retained the right to reimpose standards and specifications as necessary if the contractor's processes were not meeting requirements. This latter provision is a prudent measure when on-orbit capabilities are crucial to national security or the payload represents an expensive, national proposition.

Yet, in some cases, this course would be more costly and time consuming than the payload warrants. In those cases, virtually full commercial-like launch procurement practices would be employed, but likely only at the low end of the payload spectrum. It is interesting that Ariane is now tightening its once loose specifications, as a result of accidents. Even the European Space Agency is creating specifications and has requested a copy of our regulation for use in developing those requirements.

Closely aligned with the specification and oversight issues of H.R. 2674 is our concern with the Bill's intent to eliminate cost (and pricing) data either as part of the launch vehicle procurement process, or as might be required "for the fulfillment of the contract." Cost or pricing data submitted by an offeror enables the government to determine the fairness and reasonableness of proposed prices, aids the government's ability to determine how well an offeror understands the government's requirements, and is used by the government to understand the merit of a company's technical approach. If adequate price competition is not realized, cost or pricing data may be essential to protect the interests of the U.S., specifically whether such data was "unreasonably disadvantageous to the U.S.," as indicated in the proposed Act.

In the absence of adequate price competition and cost/pricing data, the government would be required to adopt a sealed bid process using a "qualified bidders list," where only firms which have demonstrated a capability to launch successfully and reliably would be able to compete for award. The government would no longer have the ability to structure a solicitation that allowed both established and entrepreneurial firms an equal opportunity to propose a viable bid. In effect, H.R. 2674 has the potential to hurt the range of launch providers it is trying to help, to include the innovative newcomers and entrepreneurs. With the Bill, we would also be unable to hold discussions on capabilities and clarifications, preventing understanding or corrective actions which might continue the contractor as a viable candidate in the selection process. It must be noted that certified cost and pricing data is a Federal Acquisition Regulation (FAR) requirement mandated by the Congress across the spectrum of government procurements, in response to perceived abuses by contractors.

Similarly, H.R. 2674 impacts the full range of acquisition tools and options available to the government. The Bill would impose Firm Fixed Price (FFP) contracts which are suitable only for certain acquisitions, e.g., Atlas II where the design is mature and the payload characteristics "fixed." Even the Delta II procurement was not suitable to FFP since the vehicles require extensive R&D. We are reluctant to use FFP contracting due to industry objections to assuming greater risk, without assurance of a return on investment. While this is another instance where H.R. 2674 potentially hurts the industry it is trying to help, the Act would further impact industry by not permitting government progress payments. Here, without government audit, the contractor could receive payments only upon completion of a program milestone, not on costs incurred along the way. The contractor would be forced either to fund his own progress, or to borrow until a physical event/milestone was achieved--thus, increasing his costs of doing business.

Also left unresolved would be those not unusual circumstances where rapid response procurements are necessary to meet national security payload requirements. Trying to speed schedules (at government expense) requires discussion, clarification, negotiation, and data exchange--all would require cumbersome legal waiver if the Bill became law, adversely affecting time, schedule, and costs.

Another troubling aspect of H.R. 2674 is the provisions that would require the Secretary of Defense to certify to the National Space Council those launch responsibilities that are currently under his purview and charter. The National Space Council is a policy body and was not chartered to oversee budgetary, procurement, or acquisition of space launch vehicles.

Overall, we find that proposed H.R. 2674 changes in specification, oversight, and cost/pricing data would result in a loss of quality assurance that would be difficult to rebuild if the Act's expectations were not realized. While there may be a place for similar legislation that considers the low end of the launch vehicle spectrum, across-the-board impacts are premature and not in the collective interest of the government or industry.

Finally, the Bill is not consistent with the views of U.S. CINCSPACE. In the past, CINCSPACE has favored a method, termed the Operational Launch System (OLS), for a more efficient and rapid reaction launch capability--which might lead to a CRAF-like capability for space systems. I believe he would be concerned with the increased risk that would be posed by adopting H.R. 2674. While our "operators" are willing to accept increased operational risk in the name of "warfighting," they must still have confidence that the launch of small payloads, which could augment warfighting/national security capabilities, will be successful. Relying on a no oversight/commercial practices basis during periods of hostility may not be a realistic course, since payload capabilities on orbit would be crucial to national security requirements.

Question:

Advanced Launch System

(1) In testimony last year before the Senate Armed Services Committee, General Moorman observed that "[T]oday's launch vehicles, at $3,500 per pound to low earth orbit, are too expensive. With launch call-ups of 90 to 180 days and complex payload interfaces and processing, they are unresponsive to war-fighting commanders. To change the situation will require a generational change in both payloads and launch vehicles." At the same hearing, Dr. Schneiter stated that "we can make advances at the margin on our current fifties and sixties technology systems, but we really need a clean sheet of paper if we are going to realize the kinds of changes that were talked about, particularly in terms of responsiveness, so we can decrease the time it takes to get payloads ready, to be able to launch, and to turn around the pad."

General Moorman also indicated last year that Space Command's operational requirements for more responsive launch capabilities were just as important, if not more so, as considerations of potential increased payload capacity. Moreover, General Moorman agreed that a more responsive and robust launch system, with weight and volume margins and standard interfaces, could have a significant positive impact on satellite cost -- particularly the cost of altering them and integrating them with their launch vehicles.

This year, however, when the Committee has asked why the ALS program has been on a non-development track, the common response is that there is no longer a solid requirement for launching payloads whose weight exceeds the capacity of the existing Titan IV booster. It therefore appears as though, in the end, the only factor that seems to "carry weight" within the space launch and satellite community is, if you will, the need to "carry more weight" -- contradicting the importance placed by the above-named DoD witnesses on operational considerations. Do we develop new aircraft, ships, or tanks only when the existing platform can no longer carry enough payload? Why are space boosters treated in this fashion?

Response:

Space Boosters are not developed with single launch payload capacity as a sole criteria. While it may appear that increased payload capacity was the most important aspect of the ALS program, this was not the case. Air Force Space Command's operational requirements are essential to providing reliable, resilient, launch rate capacity--to launch the required number of payloads in the needed time. The need for that launch rate capacity is one of the most compelling requirement we have for improvement in our launch systems, particularly with the Titan IV.

The ALS program was put on a non-development track because the Air Force was faced with a funding shortfall. We had the option of cutting funds to near term systems in production or delaying a future system. Given that the requirement for ALS, though still valid, was being refined and that near term mission requirements would not be impacted, a decision was made to descope the ALS program to one focusing on engine development for the near term. This decision continues to recognize that ALS is a key part of our future launch strategy and that engine development is the pacing item for a new launch system. Our emphasis on engine development first is based on two reasons. As previously stated, the propulsion tasks are the real pacing items for a new space launch vehicle family. Also, as a joint program, we will receive funding from NASA for propulsion tasks to bring to fruition our common goal of a first engine firing in FY 97. The combining of funds allows us both to meet a goal we could not accomplish individually. This approach will allow us to get back on track with ALS and bring on the development in the non-propulsion areas when funds become available with minimum impact to the overall program.

Question:

(2) In testimony last year, General Moorman was asked about OTA's cost estimate of $15-$18 billion for an ALS. General Moorman indicated that this extremely high cost estimate was based on a very "high tech" vehicle design and on expensive life-cycle costs projected for a significantly expanded mission model. General Moorman went on to note that OTA also described a much more "low tech" and cost-effective "Transition Vehicle" costing from $8 to $13 billion, and he indicated that this was the sort of vehicle the Air Force had in mind. In recent briefings to Committee staff, however, the ALS cost figures the Air Force seems to be using are still much higher. What is the current ALS cost estimate? If it is higher than the cost estimate General Moorman provided last year, why?

Response:

The $8 to $13 billion (in FY 89 dollars) referenced in General Moorman's testimony was a preliminary estimate to launch SDI's Phase I architecture. The total program cost from FY 90 through 97 for the reference ALS is $14.5 billion in FY 87 dollars for a first launch in FY 98, as documented in the Acquisition Decision Memorandum (ADM).

There are a number of factors that add to the confusion over what the ALS program is and what it will cost.

First, the ALS program was looking at a "family" of vehicles based on modular designs employing common tank and engine assemblies. The payload capacity for this "family" ranged from what we consider medium-lift launch, up through lift capabilities far in excess of what we need today to meet Air Force requirements. ALS was chartered, however, as a joint DoD/NASA program for the Nation, so some of these larger launch capacities have to be considered in the context of requirements external to the Air Force, such as SDIO and proposed NASA Space Exploration Initiatives. The launch requirements for these programs are not yet validated, but the ALS concept embraces the growth path to satisfy them in the future. Unfortunately, this was interpreted by a lot of people to mean ALS was principally a heavy-lift vehicle which the Air Force didn't need. That's not true. The right lift capacity for ALS is still an open issue, but a vehicle in the class of Shuttle, Titan, or even smaller is a very viable and attractive system for the Air Force, and brings with it the advanced manufacturing, processing, and operating technologies.

The confusion with the "heavy-lift" misnomer for ALS was aggravated by the fact that the joint program office selected one of the larger size vehicles as the basis for the cost estimate. In addition, the estimate followed the "clean sheet" philosophy of the program and assumed all the facilities and other infrastructure would be built new and essentially at one time, in order to achieve the lowest operating cost potential. There was no attempt to phase the development of the ALS or transition incrementally from the existing launch systems. We are now looking at the total space launch systems architecture in order to determine, not only what we do with ALS, but with our other systems as well. There are options to bring an ALS capability on-line in such a fashion that we get some capabilities sooner, while recognizing that our existing systems are still going to be with us. This "transition" concept, however, involves more than just the size of the ALS vehicle. It means a transition in the operations flow and ground processing where we also need to achieve low cost and increased responsiveness. While the Air Force is studying the space launch architecture, we will continue the development of all pacesetting technologies paving the way for full scale development as national initiatives and Air Force requirements dictate.

Question:

(3) Given the testimony of General Moorman and Dr. Schneiter cited above, it appears that the only way to make significant progress toward meeting Space Command's operational requirements is through a new booster program. Why should the Committee consider future improvements to the Titan IV, which could be very expensive, if the payoff will be slight in terms of meeting operational requirements? Alternatively, the Committee has been told that certain initiatives, such as payload encapsulation and interface standardization, could substantially reduce the time, cost, and complexity of Titan IV launch operations, which would, in effect, increase launch capacity and scheduling flexibility. What is the status of these initiatives, what will they cost, and will the cost of implementation further reduce the likelihood that a new booster program can be undertaken in this decade?

Response:

Based on the sizable investment in launch vehicles, launch infrastructure, and the significant cost and mission importance of the payloads we will fly, the Committee should continue to consider the initiatives to increase reliability and responsiveness.

The Air Force is currently on contract with Martin Marietta Corporation for 41 Titan IV launch vehicles with options for 8 additional vehicles. Current planning indicates that we will be flying these vehicles to the year 2000. Concepts such as payload encapsulation and interface standardization hold promise for cost reductions and increased responsiveness. The Committee should consider future improvements in Titan IV to the extent needed to support the payloads and launch rate that must fly on the Titan. The Titan IV will be the principal means to orbit for our heavier payloads until our investment in new launch technology produces a new generation vehicle and until the payloads can evolve for launch on a next generation vehicle. Based on new vehicle development lead-time alone, Titan IV will be the mainstay through the year 2000. Some investment in Titan will be needed to sustain the launch rates needed. We have programmed Titan IV infrastructure additions such as Centaur offsite processing, a new solid rocket motor assembly building, and a second West coast Titan launch pad. We are evaluating the utility and trade-offs in payload encapsulation and interface standardization and will include our recommendations in future budget submissions. The trade-off is between the capacity improvement with encapsulation and the investment and delay associated with the payload changes to provide encapsulation and standard interfaces. The lowest cost opportunities to undertake payload changes will likely occur with block changes and new starts. The timing of investments in the launch vehicle design and facility changes to accommodate payload encapsulation will depend on the opportunities for payload change. It may turn out that the transition to payload encapsulation will be more cost-effectively done in conjunction with a new ALS vehicle than with retro-fit of the Titan IV. This remains to be seen. We do not believe these initiatives will have a detrimental effect on us undertaking the ALS program. On the contrary, many of these initiatives are a direct result of the ALS program and its launch philosophy.

Question:

Titan IV

Considerable concern has been expressed to the Congress about reliability estimates for the Titan IV. The Committee understands that tests and other measures that could ensure acceptable reliability have not been funded. What tests and other activities need to be accomplished? Are they budgeted? What is the required annual funding profile?

Response:

Martin Marietta Corporation and the Titan IV program office are seriously addressing reliability issues. As you may know, Martin Marietta Corporation has one of the Defense department's leading Total Quality Management (TQM) programs in place. This philosophy emphasizes quality in the manufacturing process. In addition, we are pursuing the incorporation of several product improvement initiatives in the Titan system. It appears that in the near term the high payoff items are associated with additional liquid rocket engine testing. We have defined a Phase II Liquid Rocket Engine (LRE) demonstration program with an estimated cost of $40M for this one year effort. This program is currently unfunded and will be worked as part of this summer's Budget Estimate Submission (BES).

Question:

SLC-6/7

If Congress were to approve a new Titan IV launch pad at Vandenberg (designated as Space Launch Complex 7 or SLC-7) rather than a modification of the existing but unused Space Launch Complex 6 (SLC-6), a large part of the funding would have to be provided from Air Force Military Construction accounts, which are severely constrained, rather than Research and Development and Procurement accounts. What would the Air Force give up in the MILCON budget to pay for construction of a new launch pad?

Response:

Based on Congressional direction, the Air Force is currently pursuing modifications to SLC-6 as the second Titan IV west coast launch pad. Our budget submission contains sufficient funds (MILCON and Research and Development) for the SLC-6 project. If the decision is to develop SLC-7, we will address the impacts to our MILCON program at that time.

Senator **Wirth** [presiding]. While we are waiting for Senator Exon to come back, let me just start by keeping on my more parochial hat for a minute. Mr. Faga, we talked a little bit earlier about transferring the space launch operations from the Systems Command to Space Command, and we have communicated about that.

We talked during the break about it and I had quite an extensive sort of statement that I want to put in the record, and I will send it to you. I will not belabor the record for it at this point.

[The prepared statement of Senator Wirth follows:]

Prepared Statement of Senator Timothy E. Wirth

SPACE LAUNCH AND C3

The issue of transferring space launch operations from Systems Command to Space Command is under active consideration by the senior leadership of the Air Force. There is a lot of interest in the outcome of these deliberations on the part of the committee.

In my view, this issue is a classic test of the Goldwater-Nichols legislation. In pragmatic terms, transferring launch operations to Space Command is a crucial step in correcting our acknowledged and serious space access deficiencies.

Since the beginning of the space era, virtually every aspect of our military space operations has been managed by research and development organizations rather than operational commanders. At the beginning of this era, management by an R&D organization was probably appropriate. But continuing this way is inappropriate. Technically, our satellites and launch vehicles are superb. The problem is that they do not satisfy several important military requirements—such as responsiveness, flexibility, survivability, and simplicity of operation.

These are precisely the attributes an operational commander requires. But, unless the operational commander owns and operates the systems, he cannot properly influence their evolution. And this is what Goldwater-Nichols is all about.

I think the committee recognizes the sensitivities involved in this issue—particularly the legitimate concerns relating to your organization. I do believe, however, that these concerns can be accommodated. I also believe that what is called an organization "patch change" for the existing Space and Missile Test Organization (called SAMTO) from Systems Command to Space Command would ensure that ongoing contracts and operations would not be disturbed. Such a transfer, however, could provide the basis for achieving the Air Force policy goal of making space operations "routine."

There is reason to believe that the Air Force will act positively on this transfer proposal. If a transfer decision is not made, however, or if it is not made prior to the committee's markup next month, I will recommend the committee take some appropriate action.

Senator **Wirth**. It does seem to me that, leaving aside for a moment the transfer of where places may go, physically transfer that the sort of operational transfer to the Space Command from the Systems Command hits a lot of Goldwater-Nichols criteria.

I had talked to Senator Exon about that and I had developed this statement and he was going to follow up. Let me just put my statement in the record and read Senator Exon's.

He says: "If I may interject, I want to add my voice to that of Senator Wirth. I think it is very important that we inject operational considerations into the space launch business. We have just got to get away from this R&D approach where every launch of a satellite and its booster is a unique event, requiring month after month of meticulous preparation by an army of very expensive contractors. That is no way to run a railroad. And that is just what we need—a railroad track into space. I trust that DOD is going to do the right thing here, but if you do not, I expect I will have to look into it myself."

By that I think Senator Exon is saying we have got an authorization bill coming up and that if you all are not going to do the transfer maybe that is going to get done here. So give me your sense as to where we are, Mr. Faga, on the movement from Systems Command to Space Command.

STATEMENT OF HON. MARTIN C. FAGA, ASSISTANT SECRETARY OF THE AIR FORCE (SPACE); ACCOMPANIED BY BRIG. GEN. DONALD HARD, DIRECTOR OF SPACE AND SDI PROGRAMS, OFFICE OF THE UNDER SECRETARY OF THE AIR FORCE FOR ACQUISITION

Mr. **Faga**. It has been an issue that has been of interest in the Air Force over a number of years. There were policy examinations back in 1988 leading to increased Air Force-wide commitment to space activity in general, and a commitment to trying to normalize how space activities were conducted vis-a-vis how other activities are conducted in the Air Force.

But most recently, back in early March, the Chief of Staff, General Welch, put together a high level team under the direction of the new Commander of Air Force Systems Command, General Yates, and included the new commander of the Air Force Space Command, General Moorman and others to look at specifically how we should make the transfer from Systems Command to Space Command of launch activity—not to say that every single activity would necessarily transfer, but that we would transfer the essence of the activity.

That study was carried out by the officers appointed and reported to the Chief on May 14 and is now being prepared to go to the Secretary of the Air Force.

The two Commands involved, including the losing command, Air Force Systems Command, has recommended that essentially these activities transfer under terms of the plan that has been worked out by the two. That will be briefed to the Secretary within the next 2 weeks.

I have heard the briefing, and I will be advising the Secretary in favor of the transfer.

Senator **Wirth**. Then what does that occasion when the transfer occurs? What happens to personnel? What happens to location? Is there any change that occurs?

Mr. **Faga**. Of course most of our space launch activity occurs at our launch bases at Cape Canaveral Air Force Station and at Vandenberg Air Force Base. Most of the people who are involved are at those two locations and would remain there.

What would happen would be the start of a process under which those people would move from Systems Command to Space Command, except for some engineering activities that would remain—in some cases temporarily, in other cases permanently—under the direction of the Systems Command.

There would be a small number of people who would move to Space Command headquarters in Colorado Springs, something on the order of 100, for the management and oversight of the activity.

There would not be large numbers of people changing locations. There would be large numbers of people over a period of a couple of years who would be changing their command assignment from Systems Command to Space Command.

Senator Wirth. Then where does the shoe drop relating to the Los Angeles base that is being examined now? Where does that fall into the shift of responsibilities?

Mr. Faga. It is essentially unrelated and, in fact, the beginning of that process predates this specific examination of the launch transfer I just described.

It came about as a result of Defense Management Reviews and of a concern which has been longstanding to try to move Air Force activities out of very high cost-of-living areas, such as Los Angeles. That decision puts in motion a process which is mandated in statute, beginning with an Environmental Impact Statement, which is now under way, and that impact statement does look at specifically environmental impacts as we know them, but also economic feasibility and really all aspects of the viability of such a move.

So that is under way now, and public hearings have been held, as are required in this process, in Los Angeles to begin the consideration of moving all or part of the Air Force activities at Los Angeles Air Force Base to Vandenberg, Albuquerque or Colorado Springs or some combination of those.

That study will carry on for about 9 months and result in recommendations that would, if change is proposed, ultimately be brought to the Congress for approval as a base closure issue.

Senator Wirth. And that will be ready generally by the end of this year?

Mr. Faga. Yes. Now the distinction is it, first of all, it is not driven by the launch transfer issue, nor does it drive the launch transfer issue. In the launch transfer issue almost nobody moves physically; in this Los Angeles Air Force Base closing, if it were to occur, many people might move. And the period 1993–1994 is what is envisioned, if it were to occur. It could happen later than that.

Senator Wirth. And that is driven by expensive real estate and high cost of living?

Mr. Faga. Yes—high cost of operations in the area.

Senator Wirth. Good. My responsibility in waiting for Senator Exon is to roll us along here. Do you all have opening statements that you would like to have included in the record?

Mr. Faga. I do have an opening statement, and I would be happy to summarize it, if you wish, or go immediately to your questions.

Senator Wirth. Why don't you go ahead and do that, Mr. Faga? I think that would be helpful.

Mr. Faga. The last year of space operations activity has been a productive one. We have had 16 successful Air Force launches—three of them on the NASA space shuttle, one on the Titan IV, seven on the Delta II, one on an Atlas E, one on the Titan 34D, and the DARPA-sponsored Pegasus launch, and a Scout launch.

We have also provided five inertial upper stages for various users—two of them for classified users, and three for NASA for their tracking and data relay satellite system, for the Magellan, and for the Galileo planetary probe.

We are very pleased. I mentioned that we had seven Delta II launches. All of them were successful. They are used to launch the Global Positioning System. The last of those was in March, and they go every month or two. So we have reached the point in that Global positioning system where we have 13 satellites on orbit, leading rapidly to a 21-satellite constellation, and about 5,000 global positioning receivers are in operation by both the military and civil community.

Last June saw the first launch of the Titan IV, which is our heavyweight vehicle—the expendable launch vehicle developed to carry payloads that were originally designed for the shuttle, which was quite a high capacity vehicle. This version of the Titan replaces that capability, and at first launch in June 1989 launched a new version of the Defense Support Program, our tactical warning system.

We also launched in September the first of our refurbished Titan II systems, which is using these old ICBMs as a relatively low-cost booster of modest capability. That one launched from Vandenberg Air Force Base, and we will probably use about a dozen more of those over the next few years.

We have been very pleased with the progress of the Pegasus winged ELV, which was successfully launched recently. It is a very low-capacity vehicle, but it is one that may be very interesting for small payloads because it does offer relatively low cost and a great amount of flexibility in launching. It is launched off of an airplane, so it can go into any launch azimuth, but only with small payloads. This is not a potential Titan IV.

Senator **Wirth**. What is a relatively small payload?

Mr. **Faga**. 600 pounds, where Titan IV will launch 30,000 to 40,000 pounds.

Senator **Wirth**. Who is the prime contractor on Pegasus?

Mr. **Faga**. Pegasus was developed by Orbital Sciences Corporation out in Fairfax, Virginia.

Senator **Wirth**. And Titan IV is Martin?

Mr. **Faga**. Titan IV is Martin.

Senator **Wirth**. Waterton?

Mr. **Faga**. Exactly.

General **Hard**. That is the major facility for manufacture of it.

Senator **Wirth**. That is a major business.

Mr. **Faga**. We are also modifying a number of our facilities at these launch bases that we just talked about. We have just accepted, in early May, the modifications to Satellite Launch Complex 4-East to handle the Titan IV out on the west coast, and we have modifications either going on or planned for the two pads that are located on the east coast so they can handle Titans with Centaur upper stages, which we have had to move from shuttle applications to these Titan IV vehicles.

We are also upgrading our launch range operational equipment on the east coast.

Senator **Wirth**. Let me stop you there for a second. We heard testimony this morning from Bill Perry, former Assistant Secretary of Defense, and the issue that he had been asked to come in and address—and he was here last week as well—was talking about in a declining defense budget—we are going to move to the generic again for a minute—what are our responsibilities to, one, the maintenance of a robust R&D capability and how do you then, if you are going to do that, better link a robust military DOD R&D capability to the civilian side.

He said you have to fence that. He had some various organizational approaches and so on, but getting the specifications and the overall linkage and priority at Defense to spill to civilian and civilian people to be asking or making certain requirements of Defense.

One of his conclusions, as I understood he was telling us, is that it is imperative that we do this if we are going to maintain a robust military R&D, which he thinks we have a major obligation to do. How do you get away with it? He is saying, well, the way you do it is to get it much more involved in the civilian sector. There is going to be a lot more overlap than there has been before.

Maybe you have heard this from him before. It is a very interesting and, I think, a very compelling argument. As I listen to you talking about what we are doing with Titan IV and what kind of capabilities we have for earth surveillance systems that we were talking about before, I find myself thinking of what Dr. Perry said this morning.

Questions come to mind like is there going to be a future for a civilian space launch capability, or are we going to price ourselves out of that compared to what the French and the Chinese and others are going to be doing? Is this an area from the Perry thesis, badly described, I am sure, but I hope more familiar to you from other iterations, which we might pursue the Perry thesis and continue development here but cause greater spill-out?

That is a very generic question, Mr. Faga. I am sure you guys are wrestling with this.

Mr. Faga. Yes, we are. In fact, the whole matter of how to deal with commercial launch is under very active policy development, not just in DOD, in fact not even primarily in DOD but throughout the Government under the auspices of the National Space Council, which is headed by the Vice President.

In fact, they have a very specific study under way right now which will be completed this summer on what are the ways in which we can as a total Government respond to the opportunity of commercial launch. It is a tough problem because it is an important market, yet a limited one. Some nations are willing to subsidize it extensively. The Chinese, for example, and perhaps the Soviets as well, are really willing to sell their capabilities at whatever they can get because in their economy if they get hard currency it does not matter to them very much. They do not even have a way to measure the real cost to them.

So people tell me that the Chinese, for example, are probably willing to undercut any offer we make, subsidized or otherwise.

I think one of the most interesting events in this debate to me has been a conversation I had with a senior official at General Dynamics that builds the Atlas II vehicle. They have about 62 of them on order, both for commercial users and the Government. And their point has been only because they have these substantial numbers are they able to offer prices that are attractive and competitive to commercial customers.

In other words, we are serving both the Government and commercial users, and we are serving the Government under contracts that have been modified to limit some of the application of Government specs and a more turnkey operation, which has been contracted with them. So it has many commercial-like features.

One of the elements of this debate, which, in fact, I was going to get to later in my statement, but I know is of 15 interest to the committee that I will bring up now, is the question of whether having any Government specs, Government oversight, Government involvement, if you will, in the process inhibits commercial users.

These officials told me that they find that the judicious application of Government specs is important to their commercial customers because it provides a basis on which the customer can evaluate the product and also is important to their insurers. As you may be aware, launch insurance on the commercial market today runs something like 20 or 30 percent of the value of the payload—very, very high an insurance rate for obvious reasons.

So if you can affect those by a few percent in the use of well-understood standards, which include Government specifications, it can be very valuable in convincing the insurance underwriter that we have a basis for a reliability estimate which in the end is the basis for his insurance quote. So we do not agree with those who believe that the Government involvement is inhibiting.

I think that we need to examine aggressively—and I believe this work is under way—just what our relationship to the launch service provider should be, but I do not think that we can just step out of it and expect some magic to occur going through private investment.

Senator WIRTH. I think that is absolutely right. Let me take it to the next level of generalities. As you see the defense budgets coming down, which I think the general expectation is—that that is going to happen over the next 5 years—let us assume that that goes on. And let us assume that the thesis is correct that we have a responsibility not to allow the R&D to decline as precipitously, that maybe we should do everything we can do to keep that up and that there should be this linkage.

Then the question becomes for somebody with your set of responsibilities do you have a charter from the Secretary? Should there be one that says to you we want you to think about all of the space applications in the Air Force and the research that you are doing now, how that can be better translated or better overlapped into the civilian sector to keep our commitment up?

Am I making myself clear? This is not 10 years ago, in which what you could do was justified in terms of a military mission. Now the mission becomes more complicated, and what you have to do is in a way put what you are doing through maybe a commercial impact statement. I hate to use the words "impact statement", but do you see what I mean? You have to put a different filter on all of the items that you come up to us with.

I will bet you 2 years from now you will be asked extensively. Okay, what is the non-military application of what you are asking us to do, and we will be asking you to help make that justification.

Mr. FAGA. I would say that I have the charter. It is probably important for me to say it because in the Pentagon you tend to have about as much charter as you say that you have, but I do. But the way this is working right now is we in the Air Force participate actively with OSD in developing views for the National Space Council studies of how, in the specific case of commercial space launch, this activity could be enhanced.

Now I think you are talking more generally.

Senator WIRTH. That is right. Commercial space is an interesting model. It is sort of a case study on how this could spill to other things you might be doing.

Mr. FAGA. In that arena you certainly get well beyond my individual responsibilities, but there is a great amount of debate about development of dual-use technologies which have application to military uses and also to the civilian sector and, related to that, a great concern for the defense production base.

As you know, many of our systems use foreign parts that are readily available today but might not always be. So that is a matter of concern. In some space programs, for example, that I am specifically familiar with some of our system level manufacturers have found it worthwhile to develop custom integrated circuit capabilities so that they can build custom chips—American chips—that go into the products they are building and in fact that they can offer them at competitive prices because these are high quality parts, so the fact that they are limited production runs for these kinds of systems are economically justified.

Senator WIRTH. Mr. Chairman, Mr. Faga was going through his statement and I interrupted him. We were talking about some of the things that came up with Mr. Perry this morning in the hearing on technology and civilian transfer in a declining era.

We are getting more generic. Now that you are back, we will bring the specific charter we have here.

Mr. FAGA. Senator, I said a moment ago that I have offered a statement for the record. I was beginning to summarize, but you may wish to——

Senator EXON [presiding]. Let us go ahead. You finish your statement and then, Tim, we will go to you if you have anything to say, then we will go to questions.

Mr. FAGA. I had just gone through a brief description of some of the launch results that have occurred over the last year and explained the wide range of launch systems that we are now using.

I just talked about some of the facility modifications and improvements that we have made both on the west coast and east coast, and was just arriving at the matter of Satellite Launch Complex 6 versus 7—the second pad at the west coast which was a matter of congressional direction last year, which we have followed.

We have received proposals from the industry in response to our request with respect to modifying SLC-6, and have found them attractive. So this matter is about to be presented to the Secretary of the Air Force for decision. I will be recommending that we make modifications to SLC-6, which has been a matter of congressional direction, but you did offer us the opportunity to come back if we thought that was a bad plan.

It looks to me like it is a workable plan, and that will be my recommendation, but it will be the Secretary's choice and that has not occurred yet.

With respect to future launch capabilities, we all want a more responsive and more cost-effective and system, and we put that under the umbrella of the Advanced Launch System, which we hope would be a family of launch vehicles with capacities from something like 30,000 pounds up to perhaps 100,000 pounds or more and with a lot of improved features in terms not only-of manufacturing but also standard interfaces, automated checkout and other features that we hope would lower costs and make the system more responsive—that is, more able to reliably launch satellites soon after a request for a launch is made.

This program is in the technology stage and we are unfortunately forced by budget pressures to leave it in that status. But we do have a program ongoing now, actively and aggressively, jointly with NASA, to develop the key element of an advanced launch vehicle, and that is the liquid engine that we would use. We have a program under way that we hope will lead to a fully-tested engine by fiscal year 1997 and leave us with the ability to build a range of vehicles derived from that in the future.

In the meantime, we have a wide range of launch vehicles, some of which I described—the Delta II, Titan IV, and Atlas II—but we also have improvements that we have to make with the launch infrastructure. We are making improvements out on the range at the stations that are located throughout the world to assist the launches and operate the satellites while they are in orbit.

We have programmed the money for the construction of the second pad at Vandenberg, which, as I mentioned, will probably be SLC-6, and also a wide range of infrastructure improvements at Vandenberg, which have been ignored for years. I mean, relatively small but important items like fire protection, plumbing improvements, corrosion control, communications—a whole raft of problems that had been building over the years because we thought we were getting out of the expendable launch vehicle business, but clearly we are not.

I explained to Senator Wirth at some length that we have in the Air Force active consideration of the transfer of launch responsibility from Systems Command to Space Command, and that too is going to the Secretary within the next few weeks and I believe that the transfer will probably be made. The two commands involved have both recommended that a transfer plan be implemented.

With respect to support for commercial launch activity, we in the Air Force are strong supporters of a commercial launch activity both because it is a good national policy but also it helps us directly. The larger the base of systems from which we can draw, the lower will be our cost and the higher will be our technical performance.

However, we are not happy with H.R. 2674, which would apply extremely restrictive terms under which Government procurements of launch services would be made. I will be happy to talk more about that during the questioning, if it is of interest.

Finally, I would just like to say that the Air Force remains committed to a strong space program. We are doing very well in the space budget overall in the Air Force, and it is because the Secretary and the Chief and other Air Force officials continue to support these programs.

So although you know well that there are programs we would all like to have under way that are not under way, we have done a lot better in the space budget than in many other budgets throughout the Air Force.

Space is gradually becoming a core mission in the Air Force, and one of my tasks as Assistant Secretary is to try to further that outcome.

Thank you very much.

[The prepared statement of Mr. Faga follows:]

PREPARED STATEMENT BY THE HONORABLE MARTIN C. FAGA, ASSISTANT SECRETARY OF THE AIR FORCE FOR SPACE

Good morning and thank you for the opportunity to address the committee on the Department's space program. Over the last year the Air Force has made tremendous strides toward improving our national security space program. I'd like to review some of those accomplishments focusing primarily on space launch activities and briefly discuss what the future holds. I think you and the American public can take great pride our program.

SUMMARY OF SPACE LAUNCH ACTIVITIES

The Air Force entered the era of "sustained space operations" in 1990. Having eclipsed the recent launch recovery efforts, Air Force space launch activities over the last year included 16 successful flights; three on the Space Transportation System, one Titan IV, seven Delta IIs, one Titan II, an Atlas E, the last Titan 34-D, one Pegasus, and one Scout. By all accounts we have been successful in spreading our payload launch requirements across a fleet of diverse space launch vehicles, launch pads and support facilities. We are pleased with this resiliency and depth. In addition, the Air Force provided five Inertial Upper Stages (IUS) for two classified DOD missions and three NASA STS missions; TDRSS-D, Magellan, and Gallelio.

Let me review the constellations we supported with these broad launch programs. The Delta II program with seven military and two commercial consecutive launches, has 100 percent success rate. We have used it to launch the first seven operational Global Positioning Satellites (GPS). The most recent was launched in March 1990. The rate of GPS deployment has been about one launch every other month. With a total of six research and development satellites and seven operational Block II birds on orbit we are well on our way to achieving the full 21 satellite, plus spares, constellation. Already we are supplying highly accurate navigation and positioning accuracy for military and civilian GPS users. Approximately 5,000 GPS receiver terminals were on line in 1990. It is encouraging to see this multi-user satellite system so well received by our sister services.

As you are aware, the last Titan 34-D was launched in September 1989[deleted].

In June of 1989 we launched the first of a new generation of Defense Support Program (DSP) Early Warning satellites called DSP-1. The launch system was also new. The Air Force launched the first Titan-IV. Although it was delayed somewhat due to Cape Canaveral infrastructure conflicts and integration hurdles associated with a new payload and new booster "stack", the flight and payload deployment was successful.

A Titan-II launched a classified payload from Vandenberg AFB, California in September 1989. This was the second successful launch of the refurbished ICBM's and has proven to be a key booster for certain payloads.

Several other launch first's occurred over the year. We watched with excitement as the first Pegasus launched three small payloads over the Pacific in April of this year. A STACKSAT was launched by an Atlas E booster from Vandenberg AFB, California last month and in May a Scout launched two small communications satellites which will complement the Pegasus communications satellite providing specialized Navy support.

Space launch facilities on both coasts were improved over the last year. At Vandenberg AFB, California, the Titan-IV pad (SLC-4 East) was accepted by the Air Force on 7 May 1990. Preparations for a [deleted] launch are already underway. A sister launch pad at Cape Canaveral, Launch Complex-41 finished Phase II mods for

Centaur upper stage processing and is entering the final phase of preparations. This mod will support commercial users as well.

Range control activities at the east coast have been hampered by an aging control center and support equipment. A new Test Operations Control Center (TOOC) is being constructed with an initial capability slated for late 1991. This committee has supported the $100 million dollar funding to upgrade and improve our launch range operations. While the new facility will replace multiple range control facilities, it will also improve our launch turn-around times. Currently at the east coast it takes 2 days to re-configure the range after each launch. Quick math suggests that if two-thirds of our time is spent turning the pad around, we are left with only a hundred days per year to conduct launch operations. The new TOOC will reduce the turn around time by one-half.

Responding to congressional direction we refocused our west coast Titan-IV launch efforts from a new SLC–7 pad toward a modified SLC–6. Originally concerned that SLC–6 could not accommodate more than a two to three launch per year rate, SLC–7 was seen as the clean sheet approach with opportunity to design in growth and processing flexibility for the Advanced Launch System (ALS). Recently our contractors and an Air Force tiger team have reviewed the potential for SLC–6 launching T-IV's and concluded that processing enhancements can be designed in to satisfy operational requirements within funding limitations.

FUTURE LAUNCH EXPECTATIONS

Transitioning to a more responsive and cost effective launch system has been an Air Force goal for several years. We are painfully aware that the current fleet of space launch vehicles owe their heritage to the ICBM family and therefore are somewhat constrained in design, performance and operations. While they have served us well over the last 30 years, a new system for placing payloads into orbit is necessary for post turn-of-the-century launch operations.

Today we are looking not at a single heavy lift vehicle, but rather a family of vehicles with a range of lift capabilities from 30,000 pounds to 100,000 pounds to low earth orbit. This is the first time the Air Force has undertaken a full systems approach toward space launch and payload processing. With ensurate advancements in off-line payload processing, payload encapsulation, artificial intelligence systems, automated checkout and servicing, and standard mounting interfaces, I am sure we can accommodate our operational launch requirements after the turn of the century.

Unfortunately, the ALS program has been put on a nondevelopmental track because the Air Force was faced with a near term (1992–93) funding shortfall. The decision was made to descope the ALS program to focus primarily on engine development. We believe engine development is the pacing item for the new launch system. A program is in place to do a full engine test firing in 1997. Prototype engines will also be built which will allow for a number of test firings to ensure we have confidence in the design characteristics of the engine.

Outyear funding will allow us to return to a vigorous program for adapting related technologies, most of which exist today, into a total launch system process. NASA is now a full joint partner in the ALS program and is virtually matching Air Force funding. Currently we are jointly programming approximately 250 million dollars per year beginning in 1993. Its important to note that once the engine development cycle is complete, a full up space launch vehicle can be built in roughly the same time period the owner of the requirements can produce a satellite.

CURRENT LAUNCH VEHICLES

The Air Force will continue to refine requirements for space launch vehicles and provide capabilities within the POM budgets. We often think of having to nurse the current fleet through the turn of the century, it would be well to remember that the Delta-II, Titan-IV, and Atlas-II are all newly constructed launch vehicles. Though they are based on dated designs and technology, we have an approach to bridge that gap. It is called preplanned product improvements (P3I) and includes enhancements from ALS research. Examples of P3I include a $17 million dollar effort to upgrade the Aerospace Ground Equipment for the Titan and Delta launch facilities. The Titan-IV will receive improved avionics (guidance and control systems) which will take advantage of miniaturized circuits and improved hardening of chips and electrical components. This will result in more accurate targeting of the space launch vehicle. We have embarked on a reliability program for the Titan's liquid rocket motors. At a cost of $40 million dollars, we expect to benefit from increased confidence in engine performance.

Improvements at the launch range are also on tap. We are upgrading the transmitters in our range radars in 1992. New antennas for command transmitters will be available in 1991. And one of special note. The Delta-II vehicle will use new graphite epoxy motors (GEMs) to replace the older style castor strap-on motor. First launch of the GEM motors on a Delta-II will be in November. A Titan-II will be fitted with these GEM motors for SDIO in the future as well. The engineering and integration is being done at virtually no cost to the Air Force by the contractors.

As you know, we see the national security imperative of having dual Titan-IV launch pads on each coast. As mentioned, we are working hard to complete those facilities and will do so with the committee's continued support. Both Atlas and Delta have dual launch pads at Cape Canaveral. The Shuttle, of course, does also on Kennedy Space Center. Overall the launch rates provided by this capacity should allow us to fly off the existing backlog later in the 1990s and will go a long way toward supporting the President's Space Policy calling for "assured mission capability".

Improving the launch infrastructure at both launch bases is also a concern for the Air Force. During the period of Shuttle transition the Air Force did not allocate many resources to maintaining expendable launch related facilities and hardware. We have added some $350 million dollars across the POM to correct numerous launch infrastructure and range safety shortcomings. Total investment over the 1991-97 time frame is just over $1 billion dollars. This does not include the second Titan-IV pad at Vandenberg which is expected to run another $700 million dollars. Its often easy to eschew minor fixes to space launch facilities, hardware and support equipment but as the saying goes: "you can pay me now or you can pay me later". The "later" has arrived. An indication of this was the rescheduling of the first commercial Titan and Delta launches from Cape Canaveral. In both cases range turnaround times could not accommodate available launch windows. Coupled with weather standdowns and launch re-cycling, several weeks were added to on pad time. This can be expensive for commercial customers and impact other launches as well. I am also particularly sensitive to the personnel morale issues associated with relying on old, hard to maintain equipment.

One additional area that we are working very hard is the transition of operational launch responsibilities from Air Force Systems Command (AFSC) to Air Force Space Command. Caution will rule the day, so one should not expect many changes in the way we do space launch.

NEW ISSUES

Commercialization. I want to emphasize that the Air Force fully supports a viable commercial space industry for the Nation—both payloads and boosters—that is competitive in world marketplace. We take seriously the provisions of the Commercial Space Launch Acts, and we will continue to foster and support the growth of U.S. commercial launch providers as much as possible. We will also continue to make available our launch pads, infrastructure, people and facilities on a direct cost basis. I believe our commitment to this mission was exemplified last December when our people at the Eastern Space and Missile Center supported the successful launch of a commercial payload despite significant technical problems and weather delays. That the launch occurred on New Year's eve was a tribute to the dedication of the Government industry team who took time from their families during a normally nonoperational holiday period.

We believe a key to success of both Government and non-Government missions is a strong Government-industry relationship; the team concept that has produced tremendous achievements over the last 30 years. This success, coupled with the fact that Government payloads will continue to dominate the launch manifest well into the foreseeable future, provide a sound basis for enhancing and improving our launch capabilities.

However, we remain concerned with proposals for legislation that we believe would adversely affect a healthy Government-industry process. Specifically H.R. 2674. Before proceeding on a dramatic new course in the name of commercial space, we all need to be careful that we do not, at the same time, either hurt the still emerging commercial industry or unduly restrict sound Government practices.

Let me close by sharing with the committee several studies the Air Force has undertaken to assess our commitment to space. Back in 1988 General Welch commissioned a Blue Ribbon Panel to map a strategy for normalizing space acquisition and management efforts within the Air Force. The panel's recommendations resulted in several initiatives: A new AF Space Policy advocating a role for space as important in future conflicts as airpower has been in previous years; adoption of space as a "core mission" in our force structure; institutionalization of space within training, logistics and other functional areas; and a host of other actions now being implemented.

Complementing these "normalization" initiatives, additional space planning, programming, and budgeting efforts were accomplished. A Space Road Map was prepared and used as a foundation for a Space Investment Strategy review. The first identified mission areas for pursuit, and the second prioritized them. These reviews have led to a much crisper acquisition strategy for Air Force space efforts as we move into the 21st century.

Mr Chairman, this concludes my statement. Thank you for your strong support of the Air Force space program. I will be glad to answer your questions.

Senator **Exon**. Thank you, Mr. Secretary. Before we go to questions, is there anything you would like to add, General?

General **Hard**. No, sir, I have no prepared statement.

Senator **Exon**. First let me request unanimous consent, without objection, so ordered, that my opening statement be inserted in the record at the beginning of this panel's discussion. Without objection, so ordered.

Thank you for your statement with regard to the transfer to the Space Command. I strongly support the initiative that Senator Wirth has been involved in in this matter. It seems to me, especially during the budget crunch that we are under, this is a very worthwhile suggestion.

I think such a move would enhance our space programs and make them more efficient, so I hope that that does come to pass.

I just have a few questions. You have been very patient today. I want to compliment you, Mr. Secretary, for your timely response to our questions, which we appreciated very much, in preparation for this hearing.

I would like to have both of you address this, or maybe one can take it and answer for both. In response to the advance questions that you promptly responded to you stated that the Air Force decided to drop development of the Advanced Launch System or the ALS because it was unaffordable.

Yet in response to a subsequent question you noted that the program proposed to the Air Force leadership made no attempt to economize. In other words, despite severe budget problems, the program you asked for was for a very large vehicle and a huge infrastructure to support a vastly expanded program.

I cannot believe that it came to anyone's surprise that the Air Force should have denied this gold-plated proposal, for want of a better-term. The only way we are going to get anywhere with the ALS is to bring the cost down, and the main way to do that is to be realistic about the size of the vehicle and, of course, the number of launches.

I gather that you are beginning to inject such realism into your planning. Would you please confirm that? I think you have indicated about that in the statement you have just made, and what other reconsiderations will be made on the ALS development initiative?

If that is your intention, how soon or when will that be likely to occur?

Mr. **Faga**. I think the key change from some of the earlier emphasis in the program is that ALS was, early on, identified as a heavy lift vehicle and it was driven by the expected needs of the SDI program.

SDI has now moved to a Brilliant Pebbles base architecture, which will involve many small satellites, so that demand has changed and the demand for very heavy launch on their part has moved to Phase II, which is quite a number of years out.

So we have placed the emphasis in the program on the kinds of launch weights that we tend to operate in Air Force systems, and that is in the 30,000–40,000-pound class as opposed to the 100,000–120,000-pound class that we were talking about previously.

We do not have an aggressive program to develop a specific ALS vehicle in any weight class right now. We do have a technology program and also are investing in product improvements in some of the systems we have, particularly Titan–IV, which will be our mainstay system for at least a decade. We have only launched one. We have 41 on order and options for additional, and there are a wide range of improvements that we can make.

It is, after all, an ICBM-derived vehicle. We came specifically to Titan–IV through an expectation that we were just complementing the shuttle, and now we are effectively replacing shuttle capability for military launches. So there are a range of improvements that we can make there.

We certainly hope that the engine development that we have under way jointly with NASA will lead to a foundation for a range of ALS vehicles that would use different numbers of engines come the turn of the decade.

Senator EXON. Do you have anything to add to that, General?

General HARD. Not at this point, sir.

Senator EXON. Let me follow up a bit on looking at all alternative candidates in this ALS program.

There are several very interesting launch concepts that appear, to me at least, to be worthy of some consideration. One, of course, is the sea-launched idea proposed by the Naval Research Lab. Another possibility is an all-solid rocket system based on existing systems and existing technology.

Would you agree that the ALS program ought to be looking at some of these possibilities, if not other innovative ideas?

Mr. FAGA. I think we do need to look at all possibilities. I have talked to Mr. Wilhelm at the Naval Research Lab at some length about SEALAR, which is certainly an interesting idea and a few preliminary experiments have been conducted, as you are probably aware.

But it is at the earliest stages of development, and so we do not even know whether the concept is feasible.

Senator EXON. But you are taking a look at it?

Mr. FAGA. It is something that I am certainly interested in. I am not sure that it is a concept that solves some of the fundamental problems that we have in that it tries to reuse equipment that tends to undergo enormous wear, and it may only add to the integration problems because it would force some of the integration in environments that are not as favorable.

I do not mean to be negative at all. I do think that it is an interesting idea but not a panacea.

I am aware that the SDI is going to invest a modest amount in a vehicle sometimes called SSX, which is a single-stage-to-orbit vehicle which would depend on significant light weighting of materials that might prove in time to be a lower-cost idea. We are in coordination with General Monahan, who determined that he wanted to go ahead and fund that and carry that out. So that will be done.

Senator **Exon**. Mr. Secretary, there evidently is, then a good deal of cooperation and consideration between the ALS program and the SDI program in the meshing together of those two concepts and ideas. You evidently are pursuing those.

Mr. **Faga**. I believe that. We are certainly in constant touch with them, but particularly in ALS our cooperation is especially with NASA. It may well be that if the space exploration initiative, sometimes called the Moon-Mars initiative, proceeds as the President is suggesting that that may further clarify the needs and drive the program in a particular direction.

Senator **Exon**. I am sorry you mentioned Mars. I am puzzled. That is a great concept, but with all the problems we have right now I am not sure we can focus any great deal of attention and money on a mission to Mars.

My last question has to do with the Titan IV reliability testing, and I believe, Mr. Secretary, that you have indicated that you need some additional reliability testing on that program. It is going to cost, according to the figures that we have, about $40 million. But you have indicated in your statement that "this program is currently underfunded and will be worked as part of this summer's budget estimate submission."

I take it, then, that the Air Force did not include these tests in the new 6-year budget that was sent to us by the Secretary. I do not necessarily regard this as an encouraging sign when we are trying to get a handle on the future of this program.

How important or how critical do you think these tests are in ensuring reliability of the Titan IV rocket engine? What priority would you assign to it?

Mr. **Faga**. Well, let me give you a little background to the specific testing that we are talking about. Of course, all space systems, including boosters, undergo a great amount of reliability testing both to qualify components to be used and then also specific components on an individual vehicle that actually is going to be flown.

Based on some analysis done by a firm called L Systems, Peter Leonard carried out an analysis using historical data that showed most often it was engine failures that caused catastrophic failure and, therefore, that more emphasis on proving the reliability of a liquid rocket engine should be undertaken.

We agree with that, and I am about to throw the ball to my colleague and see where we stand on funding. I know that we plan to fund it.

General **Hard**. We have not completely funded it, as the answer says. We are facing a very difficult period. If I could go back and perhaps capture some thoughts that went through my mind earlier, our pressing near-term problem is to try to live with the present launch vehicle family. We have to pick up the rate that had been allowed to drop as we tried to go to the shuttle program and now are trying to overcome as a result of the launch disasters we had in both shuttle and Titan—to pick up that rate so that we can launch the backlog and sustain a launch rate that will meet our immediate needs for vehicles that are designed for today's launch vehicles.

Yet we know that in the future we want to go to a new generation of vehicles that is more reliable, more economical, more easy to operate than today's, and trying to make that jump from today to tomorrow is a very difficult thing to balance, particularly in this particular budget environment.

We have chosen within the ALS program to focus our energies on the long pole in the tent—that is, the engine development—but we also know that if we want to get some payback on our investment, if you will, we have to improve today's vehicle so that we can rely on it more confidently while we fly them out until we get to the next generation.

All of this, of course, requires a great juggling act, especially, as I said, in the present budget environment. We do not enjoy the same posture that we do, for instance, in the advancement of technology for air turbine motors, where there is a continuing technology base for continued modernization, and it is almost taken for granted that we would do the kinds of things that we are taking on as a special effort to go to ALS.

So within that the answer is plain and simple. No, we have not been able to get all the funding that we would like for all the efforts that we think are necessary, and we are just trying to do our best in terms of balancing that to respond to the most pressing needs we think we can respond to and still keep a balance between meeting today's problems and also preparing for tomorrow's future.

Mr. FAGA. Let me come back to a point you raised specifically in your question, which is how important do we see specifically the liquid rocket engine testing. I see it as valuable. I do not see it as urgent. What Peter Leonard has done is to focus on that specific area of historical failure. It is not a matter that the engine we are using on the Titan IV has any special problem; it is a matter of recognizing that this tends to be an area of severe failure historically, and so we should put more emphasis on it in our reliability program.

Senator EXON. Gentlemen, thank you very much. There will very likely be additional questions for the record that we would appreciate your giving as prompt an answer to so we can include it in the record.

I appreciate very much the fact that you have been here today. It has been a long afternoon and I just wanted to pledge that we are interested in working with you on all of these problems. I suspect that you must be as frustrated as we are, given the budget crunch that we face on all programs.

So thanks for being here and please keep in close touch with us and let us know as early as you can when you make these difficult decisions we've discussed today.

So with that, I thank you for being here and we are adjourned.

[Whereupon, at 4:15 p.m., the subcommittee adjourned.]

DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEAR 1991

WEDNESDAY, JUNE 6, 1990

U.S. Senate,
Subcommittee on Strategic Forces
and Nuclear Deterrence,
Committee on Armed Services,
Washington, DC.

THE B-2 PROGRAM

The subcommittee met, pursuant to notice, at 9:07 a.m., in room SD-106, Dirksen Senate Office Building, Senator J. James Exon, (chairman of the subcommittee) presiding.

Committee members present: Senators Exon, Levin, Glenn, Gore, Wirth, Warner, Thurmond, Cohen, Wallop, Gorton, and Lott.

Committee staff member present: Arnold L. Punaro, staff director.

Professional staff member present: William E. Hoehn.

Minority staff members present: Brian D. Dailey, George W. Lauffer, John E. Mansfield, and Durwood W. Ringo, Jr., professional staff members.

Staff assistants present: Mary J. Kampo, Kelli J. Pronovost, and Mickie Jan Wise.

Committee members' assistants present: Andrew W. Johnson, assistant to Senator Exon; Kenneth N. Luongo, assistant to Senator Levin; William J. Lynn, assistant to Senator Kennedy; Christopher E. Paine, assistant to Senator Kennedy; John Gerhart, assistant to Senator Bingaman; Milton D. Beach, assistant to Senator Glenn; Leon S. Fuerth, assistant to Senator Gore; Jefferson B. Seabright, assistant to Senator Wirth; Terence M. Lynch, assistant to Senator Shelby; Christopher K. Mellon, assistant to Senator Cohen; Patrick F. McCartan, assistant to Senator Wilson; Charles G. Pearcy, assistant to Senator Lott; Eric H. Thoemmes, assistant to Senator Coats; and Thomas G. Moore, assistant to Senator Wallop.

OPENING STATEMENT OF SENATOR J. JAMES EXON, CHAIRMAN

Senator Exon. The subcommittee will please come to order.

The subcommittee meets today in open session to review testimony on the B-2 bomber program in support of the fiscal year 1991 budget request. The subcommittee met previously on May 10, in closed session, to review the various highly classified aspects of the B-2 flight test program and the capabilities of the B-2 and other low-observable air vehicles.

Today's hearing takes place against a backdrop of both Secretary Cheney's recent decision to reduce the planned buy of the B–2 bombers from 132 to 75, and the ongoing efforts in both the House and the Senate to terminate the B–2 program forthwith. This hearing, thus, is likely to be crucial to the continuation of the B–2 program, as this is in all likelihood the last opportunity before markup begins on the defense budget request for the Air Force to make the case for continuing this program.

Two of the best witnesses to make that case before us have been here before and we are very glad to have them both back this morning. Prior to becoming Secretary of the Air Force, Donald B. Rice had a long and very distinguished career in the analysis of major weapon systems, both in government and for many years as president of the RAND Corporation, the Nation's best known think tank.

Welcome, again, Mr. Secretary. And we are glad to have you here.

Secretary RICE. Thank you, Mr. Chairman.

Senator EXON. General Larry D. Welch is the Chief of Staff of the Air Force, in which position he is capping an illustrious career in the Air Force. I would be highly remiss if I did not offer my personal congratulations and my sincere thanks, and those of the Armed Services Committee as well, to General Welch for a job well done.

General Welch, we welcome you again before our committee.

General WELCH. Thank you.

Senator EXON. General, let me vent a little frustration right from the start. As you both know, I have been a strong supporter of the B–2, while incorporating several safeguards that I think are both necessary and have been agreed to by all members of the committee, and I think both of you. I believe it would be a revolutionary development if indeed this program works out as planned, and it would be a significant further development of air power, and probably nothing more important as far as military preparedness is concerned, maybe comparable only to the development of radar some 50 years ago.

The capabilities of this airplane are truly awesome, and all should understand that, as our earlier closed hearing made that fact very plain, above everything else. Yet, this was a closed hearing, indeed, a highly restricted hearing, and I must say it was not as well attended by the members of the committee as I would have liked.

I have asked the Air Force repeatedly, and I emphasize the word repeatedly, to give us some unclassified comparisons or examples of the B–2's capability to evade detection of air defenses. I have begged them to sift through their classified charts and give us some understandable comparisons and examples—not to persuade me, since I was at the briefing and I am a supporter.

The B–2 program will be debated vigorously on the Senate floor, and in the end, Senators, many of whom are woefully ignorant of what the B–2 can do, will have to vote to continue the program or kill it. In that debate, I and other B–2 supporters on this committee will press the case. But we cannot use highly classified information that we have received for obvious and good reasons. We will have to argue the merits of the program at an unclassified level against opponents whose main argument is both unclassified and readily understandable, which is simply the cost of the B-2 program itself.

And, gentlemen, the Air Force has not been very timely with the help that we have requested time and time and time again. Chairman Nunn and I wrote a letter to Dr. Rice and Secretary Cheney on March 5 of this year, with a long list of unclassified questions. We received the answers less than 24 hours ago, barely in time to read them prior to this very important hearing.

And while I am talking about those things, although neither of you have any direct responsibility for this at all, for the second time in a month we had to cancel another very, very important hearing on the SDI program. Three weeks ago we were scheduled to take that up. We did not have the report that had been promised us for a long time.

Hours before that meeting was canceled 3 weeks ago we were assured that there would be a courier coming over from the Pentagon with the report. We did not receive it in time and we canceled the hearing. We simply have to have this information in advance, and we do not think that the Pentagon, in general, has been as forthcoming on these matters for reasons that we simply cannot understand.

Gentlemen, I hope that your testimony today, though, can help to arm us for the upcoming battles in the committee and on the floor of the United States Senate over the B-2. We will hear from you in just a minute, but first, let me invite my distinguished colleague, Senator Warner, for any opening comments that he might have.

I would also like to submit for the record the opening statement of Senator Strom Thurmond.

[The prepared statement of Senator Thurmond follows:]

PREPARED STATEMENT OF SENATOR STROM THURMOND

Mr. Chairman, I want to join you in welcoming Dr. Rice and General Welch today to discuss the B-2 bomber program. General Welch, I understand this may be one of your last appearances before the subcommittee; I want to say I am grateful for the service you have given your country and especially for the assistance you have given this committee.

Mr. Chairman, this is a very important hearing. It may be the most critical hearing we will have this year. For at stake is the clear and single principle that has guided this subcommittee since it was established: the United States must always have a strategic deterrent that is undeniably powerful and survivable, so that the Soviets will always know that they, the leaders and organs of state power, face sure and rapid destruction if they ever unleash nuclear war.

Why do I say that this principle is now at stake? Because unless we decide to modernize now, we will enter the next century with an older force, a compromised force, a force vulnerable to Soviet defenses. Decisions we make how will determine the effectiveness of our Triad for years to come. We have to modernize. As Senator Warner has said, "Arms control must not mean strategic atrophy."

While the United States is arguing, the Soviets understand this perfectly. With all their problems, with the economy in shambles, with the military budget plummeting, with their forces in retrenchment in Europe, with their cities plagued with ethnic unrest: the Soviets are moving ahead at top speed to modernize their strategic forces. Strategic forces count. The Soviets know this. We should know it too.

But, what are we doing? We are arguing whether we will have a mobile ICBM or not, we are questioning whether DOE will be able to make warheads for the Trident, we quibble about "crisis stability" and "cost effectiveness at the margin"—and we talk about abandoning the most important development in military technology in years: the Stealth bomber.

Mr. Chairman, I hope we do not lose the fight for this bomber. We know that the Soviets have not in the least slowed up their research to defeat our strategic forces. That is why we have always relied on a Triad. If we stop the B-2, we give away one leg of the Triad. Then we will be relying on ICBMs and submarines. We know the Soviets can destroy the ICBMs in their silos. Can we be sure they will never find the Tridents?

Dr. Rice and General Welch, I hope you can help the subcommittee come to grips with this issue today. Although I agree with you on the need for the B-2, I am very concerned about the cost of the program at a time when we anticipate large reductions in defense spending.

Thank your Mr. Chairman.

Senator WARNER. Thank you, Mr. Chairman. I always enjoy working here with this subcommittee and under your leadership.

Mr. Chairman, first I would like to acknowledge again the contributions being made by Secretary Rice. I hope you are enjoying this job, Mr. Secretary. I had the pleasure of serving in the Navy in that position for many years, and we were pleased to see that you accepted the President's invitation and challenge to take on this important task at this critical time.

And, General Welch, this may well be one of your last congressional hearings. I suppose you look upon that with some mixed feelings, but I have had the privilege and the opportunity to work with you now for 4 years, and I wish you well on the next chapter of your distinguished career in public service or private, whatever it may be.

I think the hearing is an important one, Mr. Chairman, that you have called this morning. It has ramifications that go well beyond the technical capabilities of this weapon system. We have just witnessed an historic summit. Mr. Gorbachev made it very clear of their intentions to go forward with their modernization of their strategic programs within the framework of whatever arms control agreements we may eventually be able to work out.

But the bottom line, the one thing that gives the Soviet Union superpower status today is not their economy, not their political philosophy, it is the arsenal, the awesome arsenal of nuclear weapons. And it is imperative that this Nation continue our modernization program. We have relied since almost the very beginning on the concept of the triad. An air leg, a sea leg, and now we are considering this particular modernization in the program here of the air leg. Eventually we, the Subcommittee, will go back and visit the third leg, the ground-based leg.

This particular system, and I have had the opportunity to go out and see the aircraft, as I am sure you have, Mr. Chairman, on several occasions, it provides the best technology that America can bring together today, basically, incorporating the Stealth technology. And it provides the best flexibility. It gives the President of the United States, this President and future presidents, the ability to make a key determination in deterrence of releasing a system, but being able to recall that system before it completes its mission and delivers the weaponry.

It has the best survivability against the air defense system that the Soviet Union has put together very carefully over many years. We do not have in this Nation anything comparable to the Soviet Union in terms of air defense. But if we are to continue to predicate our concept of deterrence on a triad, then we need a system which can survive in an air defense that the Soviet Union now has.

So, Mr. Chairman, I wish you well on this. Also, this program is integral to the ongoing START negotiations. A great portion of that treaty is conceived on the concept of this program going forward and that this weapon system will become operational in our system of deterrence.

I thank the Chair and I thank the witnesses.

Senator Exon. Thank you, Senator Warner.

Just let me add a comment or two in that regard. I heard a Member of Congress recently say that the Congress cannot be expected to buy every airplane that General Chain has on the drawing board. Well, the facts of the matter are, as you both know so well, there are no bombers on the drawing board.

If the B-2 is either killed by the Congress or if it fails in testing, which I do not think it will, then I think that we should recognize that, beginning in about 1997, we would begin to see the end of the nuclear triad that has served as this Nation's deterrent so well.

Before we recognize the witnesses, let me just say that I note with interest the presence in the hearing room of a number of company-grade officers from the Air Force Systems Command who are here observing the legislative process. We are pleased by your interest, and we are glad to have you here.

Now let us proceed with the witnesses. I suggest we begin with you, Secretary Rice.

STATEMENT OF DONALD B. RICE, JR., SECRETARY OF THE AIR FORCE

Secretary Rice. Thank you, Mr. Chairman, and good morning.

General Welch and I welcome this opportunity to discuss the B-2 program with you, a program that, as you and Senator Warner have pointed out, is crucial in terms of long-term importance to our national security.

We have, this season in the Air Force, tried to be sensitive to the concerns you raised earlier about the need for significantly greater amounts of information in the unclassified domain, in the public domain, about the B-2 program. We have provided you with several documents, a position paper and a briefing, that lay out the need for the B-2, and separately, an unclassified analysis of how Stealth works and how to understand what is involved with the utilization of Stealth technologies.

I urge the committee to review them at your leisure, and ask that they be included in the record of this hearing.

Senator Exon. Without objection, that is so ordered.

[The information referred to follows:]

THE CASE FOR THE B-2

June 1990

SUMMARY

The United States Air Force's commitment to the B-2 bomber is rooted in the historical experience of long-range bomber development and operations, the bomber's indispensable role in supporting nuclear deterrence, and the unique flexibility that makes it a particularly effective weapon for conventional operations and the projection of U.S. power.

Understanding the flexibility of long-range bombers—in both nuclear and conventional operations—is the key to understanding their utility in supporting U.S. national security objectives across the spectrum of potential conflict. The rapid changes in the global security environment have added unprecedented uncertainty to our security planning and have increased the importance of flexibility and adaptability when developing weapon systems and force structure.

The bomber enhances the stability of the nuclear balance. Its high survivability promises any aggressor that an attack will be met with devastating retaliation, while its relatively slow speed compared to ballistic missiles means that the bomber does not pose a credible first strike threat. Because it can be generated, dispersed, launched under positive control, and then recalled or redirected, the bomber also provides our nation's leaders with a highly flexible means of sending a variety of unmistakable messages to an adversary to help defuse and stabilize crises.

In nuclear operations, the penetrating bomber provides the best combination of accuracy and weapon yield compared to any current or projected Triad system. The crews' capabilities to assess whether sites have useful targets present and whether high priority locations targeted by more than one weapon require a follow-up attack enhances efficiencies. In essence, the penetrating bomber can hold more targets at risk than the actual number of weapons carried. The penetrating bomber's synergistic relationship with cruise missile carriers also enhances the effectiveness of the air breathing force as a whole.

The bomber's unique flexibility in projecting conventional power will become even more vital in these times of instability, uncertainty, and rapid change. The long-range bomber employing conventional weapons can deter, deliver a tailored response, or punch with devastating power if required against any location on the planet in a wide variety of roles. Indeed, the bomber is one of the nation's premier power projection assets.

The B-2 bomber has resulted from a conscious attempt by successive Administrations and Congresses, representing both political parties, to ensure that the bomber force remains a viable deterrent in the face of expanding ground-to-air and air-to-air threats. The United States' future bomber force must be capable of operating in the face of highly sophisticated air defense systems in both nuclear and conventional operations. The B-52 is already so constrained by advances in air defense technology that it is losing its viability as a penetrating bomber against sophisticated defenses. The B-1, whose design dates to the mid-1960's, will continue as a useful system for years to come. However, it too will be increasingly constrained by the evolving air defense threat environment, particularly in the post-2000 time period. The B-2, which incorporates stealth

technologies to reduce its signature in a wide array of spectra, is the penetrating bomber of the future.

Without the B-2, the bomber fleet will atrophy and bomber penetration capabilities will decline. Together, these events will lead to eventual disintegration of the balanced Triad concept. By the year 2000, for example, the force would deteriorate to less than 200 B-1 and B-52H bombers, half of which—the B-1s—will be 14 years old; and the remaining half—the B-52's—will be at least 40 years old. By that time it will have been 55 years since Air Force planners first envisioned the B-52, and almost 40 years since they envisioned the B-1. Eventually the force would shrink to only the B-1. Our deterrent capability would degrade as U.S. forces lose the penetrating bomber's flexibility and efficiency in delivering nuclear weapons. And eventual reliance solely on B-1s as non-stealthy cruise missile carriers would degrade effectiveness and open new vulnerabilities.

In the conventional role, the B-2 will be a formidable weapon. Its stealth characteristics make defense against such a bomber extremely difficult, while its long-range and high payload ensure that any adversary would remain vulnerable. In short, its very existence could deter aggressors from threatening the security of the United States and allied nations around the world. The B-2 will be able to penetrate to any location on the planet to deliver massive quantities of ordnance precisely. Like the B-52 and B-1B, it can be configured to meet the changing needs of U.S. national security, while its stealth characteristics will provide it with important survivability advantages over these older bombers. But a failure to build the B-2 would force dependence over time on the existing fleet of 97 B-1s, which in turn would become a much more critical component of the Triad.

The need for the B-2 is real. It has not been mere technological fascination that has led successive Administrations and Congresses to enthusiastically support the evolution of stealth technology, the deployment of a stealth fighter, and now the development and anticipated deployment of the B-2 bomber. Rather it has been the cold, pragmatic recognition that stealth technology is among the most significant military technologies to appear in recent decades—and one in which the United States enjoys an unprecedented lead.

The B-2's exploitation of stealth technology will enable it to remain a viable penetrating bomber for the foreseeable future. Years of analysis and operational tests have uncovered no "Achilles' heel" that could provide defenders in future with a means of countering stealth. The acquisition of the B-1B provided a valuable breathing space in which to mature and develop the B-2's revolutionary new technologies, materials, and processes, which have provided the United States an unprecedented lead in the stealth field. The developers of the B-2 followed a risk reduction development philosophy, with extensive ground and laboratory studies preceding any significant design and manufacturing decision. Computer aided design and computer aided manufacturing streamlined the process. The B-2 has benefitted from extensive testing before first flight, while the highly successful flight testing program has demonstrated its stability and safety. Carefully planned integration of Air Force and contractor personnel will enable the aircraft to begin a smooth transition into operational service.

Cost has emerged as one of the most important issues in determining whether or not the B-2 program goes forward. B-2 cost must be put into perspective. The B-2 is certainly not the most expensive weapon system under consideration. Currently, on a cost-to-complete basis for the planned 75 aircraft force, the program is the seventh largest compared to other ongoing DoD programs. On a per unit basis, B-2 costs are comparable to other weapons. For example, on a "flyaway" or "sailaway" basis—the cost to build a weapon system after the expenditure of research and development funds—each revolutionary B-2 (for a buy of 75 aircraft) costs about the same as a naval frigate. A system's value must be judged on the basis of its contribution to U.S. national security, not just on its cost.

The stealthy B-2 will become the backbone of the bomber fleet—and thus provide U.S. national security with the stabilizing, deterring, and flexible capabilities of bombers for the long term. The bomber, and the survivable penetrating bomber in particular, is a flexible weapon that can be adapted to meet the changing needs of U.S. national security policy. The most effective method of maintaining the viability of the bomber force is to procure the B-2. The Air Force's plan for the 1990s, "The United States Air Force and U.S. National Security: Global Reach—Global Power," capitalizes upon the inherent characteristics of airpower: speed, range, flexibility, precision, and lethality. The B-2 in many ways epitomizes airpower's inherent attributes—it provides true global reach and deterring global power.

I. INTRODUCTION

The United States Air Force's commitment to the B-2 bomber is rooted in the historical experience of long-range bomber development and operations, the bomber's indispensable role in supporting nuclear deterrence, and the unique flexibility that makes it a particularly effective weapon for conventional operations and the projection of U.S. power. This paper first examines the case for the long-range bomber (and the penetrating bomber in particular) to illustrate the critical role these aircraft will continue to play in supporting U.S. national security. Subsequent sections demonstrate why the B-2 is the most effective means of maintaining the multi-faceted contributions of the United States' bomber force for the long term.

II. THE CASE FOR BOMBERS

Bombers appeared in the First World War, but the relative immaturity of aviation technology and the small numbers of such aircraft did not permit exploitation of their capabilities until the Second World War. In that conflict, both Allied and Axis powers employed bombers to conduct maritime patrol and attack missions; provide key support for troops during land battles; furnish strategic reconnaissance, electronic countermeasures, and electronic intelligence; and launch cruise missiles and guided weapons at shipping and industrial targets.[1] Allied bombers devastated German and Japanese cities, industries, transportation grids, and energy networks. Finally, American B-29's dropped two atomic bombs on Japanese cities, shattering a theretofore persistent will-to-resist that could have cost millions of American, Japanese, and allied casualties during an anticipated invasion of the Home Islands in 1946.

After 1945, the United States, the Soviet Union, Great Britain, and France embarked upon the development of atomic-armed bombers. For almost a decade, the bomber was the only nuclear intercontinental weapon. The intercontinental ballistic missile (ICBM) and various cruise missiles (both ground and air-launched) complemented the bomber force in the 1950s, followed by the submarine-launched ballistic missile (SLBM) in the 1960s.

Soviet nuclear forces today have the capability to destroy our nation—and the Soviets continue to modernize. The U.S.S.R. is currently deploying four new ICBMs (the SS-18 Mod 5, silo and rail based variants of the SS-24, and the road mobile SS-25), strategic nuclear submarines and associated SLBMs, and three types of bombers (Blackjack, Backfire, and Bear H). To put this in perspective, last year the Soviets deployed 140 new ICBMs; the United States produced 12. Soviet forces are likely to be reshaped to meet arms control constraints, but will continue to improve in capabilities. For the foreseeable future, the Soviets will retain the capability to deliver thousands of nuclear warheads against our nation.

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[1] German bombers launched V-1 cruise missiles against England and employed guided weapons to sink naval vessels. The United States employed television- and radio-guided weapons (the GB-4) against U-boat pens in 1944 and precision-guided weapons (the Azon VB-1 missile) in both the European and Pacific theaters. American cruise missiles derived from the German V-1 were entering service just before the close of the conflict.

Deterrence of nuclear attack is the cornerstone of U.S. national security. To deter an attack, the United States has developed forces—the well-known Triad of air-, land-, and sea-based nuclear forces—that can retaliate, even after absorbing a first strike, to devastate an attacking nation. The Triad has provided an effective deterrent for three decades and its success has led to a broad national consensus that we should maintain a balanced Triad composed of modernized, effective individual "legs."

Each leg of the Triad possesses certain unique and complementary characteristics which, synergistically working together with the other legs, provide a retaliatory capability that no adversary could hope to successfully overcome. The individual elements of the Triad work in combination to confound an adversary's offensive and defensive strategies—the diversity of basing modes and penetration profiles posed by the different legs dramatically complicates the problems facing an enemy. Fast flying ballistic missiles pose one set of problems; slow flying air-breathers another. The Triad also provides a high confidence barrier against system failures, communication problems, technological breakthroughs, and unforeseeable events that inevitably occur in the heat of combat.

The bomber leg, composed of both penetrating bombers and cruise missile carriers, provides unparalleled flexibility to the Triad. *No other Triad system offers the flexibility and adaptability of the bomber.* ICBMs and SLBMs are dedicated solely to nuclear deterrence—the bomber force can provide nuclear deterrence *and* conduct conventional operations. Understanding the flexibility of long-range bombers—in both nuclear and conventional operations—is the key to understanding their utility in supporting U.S. national security objectives across the spectrum of potential conflict. The rapid changes in the global security environment have added unprecedented uncertainty to our security planning and have increased the importance of flexibility and adaptability when developing weapon systems and force structure.

The B-52 offers a useful example. Originally developed as a high altitude nuclear penetrating bomber, this aircraft shifted to a low level penetration mission in the early 1960s, and has been successfully modified numerous times to adapt to continuously evolving mission requirements and threats. For the nuclear mission, the B-52 was equipped with short-range nuclear attack missiles to attack heavily defended targets, and then with cruise missiles to maintain its deterrent potential in the face of strengthening area air defenses. B-52s, flying thousands of conventional missions in the Vietnam War, emerged as the weapon the North Vietnamese feared most. More recently, some of these bombers have been dedicated solely to support conventional maritime and land attack operations. In the maritime role, they provide capabilities unmatched by any other system—mining, rapid response anti-ship missions, and surveillance. Some have also been configured to conduct precise conventional attacks with stand-off weapons. The capability to reconfigure the B-52 to meet diverse mission needs illustrates the inherent flexibility of large, long-range, high payload bombers to meet the uncertain and shifting demands of U.S. national security strategies. And the lengthy service of the B-52 illustrates that decisions regarding the bomber force must be taken with the long-term future firmly in mind.

A. Bombers Enhance the Stability of the Nuclear Balance

The fundamental goal of the United States in shaping the nuclear balance between the superpowers is to increase stability—to reduce incentives for either side to launch an attack in either peace or crisis. The bomber is the most stabilizing element of the Triad. Its capabilities to send a variety of unmistakable messages to an adversary provides our decision-makers with additional options to help defuse and stabilize crises; its high survivability ensures devastating retaliatory capability; and its slow speed, compared to ballistic missiles, makes it unsuitable as a first strike system. Together, these attributes enhance the stability of the nuclear balance.

The bomber force can be rapidly generated, dispersed, and/or launched under positive control and subsequently be recalled or redirected. These capabilities give U.S. leaders a variety of additional options to help defuse a crisis. This versatility allows the United States to demonstrate resolve by a controlled means of escalation short of actual conflict, thereby decreasing the chances of a nuclear war. Several historical examples illustrate the bombers importance in stabilizing crisis situations. In the late 1940s, nuclear capable bombers were deployed to Europe to dramatically emphasize U.S. concern over Soviet actions. During the Cuban Missile Crisis of 1962, Strategic Air Command put over 1500 bombers on alert to convey the seriousness with which the United States viewed Soviet activities. Some of the bombers stood strip alert or deployed to dispersal bases; others flew airborne patrols at forward orbit points to demonstrate convey U.S. concern.

Generating the bomber force can be carried out very rapidly, significantly increasing the total number of warheads on alert. This rapid increase in retaliatory potential sends a clear signal of national resolve—a basic component of deterrence—that cannot be matched by the other legs of the Triad. ICBMs in silos and on-station ballistic missile submarines have no capability to show national resolve and concern; attempts to flush submarines refitting in ports could take too long in a rapidly escalating crisis.

The physical characteristics of bombers also add to the stability of the nuclear balance. Bombers enjoy high survivability, thus promising an adversary that an attack would be met with a devastating response. But bombers make poor first-strike weapons. A massed launch of bombers would be difficult to conceal from the Soviet Union, which possesses modern intelligence gathering systems, while the slow speed of bombers (compared to ballistic missiles) prevents them from delivering sufficient numbers of weapons simultaneously to cripple Soviet retaliatory capabilities. The relatively long time it takes for bombers to reach their targets provides an additional stabilizing element because the leadership on both sides has time to contemplate the consequences even after the bombers have launched. The presence of a person in the bomber cockpit also provides leaders with the capability to terminate (or reduce the scope of) a retaliatory strike.

The bomber's attributes have led both the United States and the Soviet Union to regard it as the most stabilizing element of modern strategic forces. Under proposed START counting rules, each reentry vehicle warhead (RV) of the fastest flying weapons—ICBMs and SLBMs—counts as one weapon. Overall, a maximum of 4,900 ballistic missile warheads are permitted toward a total force level per side of 6,000 accountable warheads.

Different accountability rules are applied in the START negotiations to the various types of bombers. Bombers are configured in three different ways for nuclear operations: 1) a penetrating bomber enters enemy airspace to deliver gravity bombs and short-range attack missiles (SRAMs); 2) a "shoot/penetrate" bomber first fires air-launched cruise missiles (ALCMs) and then enters enemy airspace to deliver other weapons; 3) a "stand-off" bomber is only equipped with cruise missiles—it launches these weapons from outside enemy airspace, but does not penetrate.

Under the current U.S. government position, each U.S. ALCM-equipped bomber (configured for either stand-off or shoot/penetrate missions) would count as ten warheads (even though, for example, each ALCM-capable B-52 can carry a maximum of 20 cruise missiles). Penetrating bombers count as only one warhead, regardless of the number of individual devices carried on board. For example, under the proposed START guidelines, a single Trident submarine (192 warheads) counts as more accountable warheads than the entire projected force of B-1s and B-2s (which will carry over 2500 nuclear warheads).

The United States will continue to rely heavily upon the bomber force to cover critical targets. Only the penetrating bomber provides the leverage in a START-constrained world to meet future target coverage requirements while simultaneously increasing the stability of the nuclear balance. And even if future arms control agreements reduce the counting rule advantage of the penetrating bomber, a pure cruise missile force would still not provide the same capability as a mixed force. Reliance solely on cruise missiles would create a less flexible, less capable, and more vulnerable force, as discussed in the following section.

B. The Penetrating Bomber and Nuclear Operations

The manned penetrating bomber is the most efficient, flexible, and effective system in the Triad against the large number of diverse targets which must be held at risk to ensure deterrence. The key to the penetrating bomber's warfighting versatility and efficient weapon delivery is the presence of a person in the cockpit capable of reacting to situations and making decisions. The penetrating bomber is the only nuclear system that can react if an adversary does something unexpected—a recurrent theme in the history of conflict. In sum, penetrating bombers are particularly deterring because they make any potential adversary realize that no sanctuary exists for the most valued elements of his power.

The presence of a person in the loop makes the penetrating bomber the most efficient employer of nuclear weapons—an attribute of increasing importance in the context of arms control constraints. The penetrating bomber's crew can check key targets, such as naval bases, ground force dispersal locations, and airfields for occupancy using infra-red, visual, or radar sensors. Modern radar systems offer extremely high resolutions from great distances. For example, crews employing the radar suite in an F-15E tactical fighter can determine if cars are present in driveways from 50 miles away—the more powerful radars in modern bombers have even greater capability. Emitting for only short periods, crews can quickly examine potential targets in a nuclear environment without compromising survivability. If a location is occupied, the bomber can deliver weapons; if not, it can continue to the next site. A missile obviously cannot do this; once launched, it is on its way. The penetrating bomber is also more efficient against high priority targets targeted by more than one weapon to ensure destruction. The crew can assess previous target damage and deliver a follow-on attack to achieve an adequate level of damage or withhold weapons for subsequent targets later in the mission, thereby ensuring target destruction while holding more targets at risk. Penetrating bombers can also adjust aimpoints based on radar, infrared, or visual checks to increase the effectiveness of attacks.

Physics also plays a role in enhancing the penetrating bomber's delivery efficiencies. Multiple independently targetable re-entry vehicles (MIRVs) carried by ballistic missile systems are restricted in their employment "footprint"—the area in which an ICBM/SLBM's warheads can land. The number of targets that cruise missiles can strike are limited by a combination of the cruise missile's range and the distance at which the launching aircraft must launch these special weapons. Effective penetrating bombers have the range, routing, threat evasion, and retargeting flexibility to provide essentially unlimited options in attacking a variety of targets over a much wider area.

In addition to these efficiencies, the penetrating bomber offers the best combination of accuracy and weapon yield compared to any current or projected Triad system. This provides important advantages when dealing with very hard targets (such as command and control facilities) and area targets (such as ground force dispersal sites). Planners would have to expend multiple SLBM, ICBM, or cruise missile warheads to achieve the same level of damage as that provided by a single bomb from a penetrating bomber.

Finally, penetrating bombers, such as the B-2, still offer the best potential for defeating mobile relocatable targets—the fastest growing component of the Soviet target base. It should be noted that mobile ICBMs, such as the SS-24 and SS-25, form only a small portion of the mobile Soviet target base, which includes maneuver forces in the field, command and control elements, other direct support elements, aircraft, and naval forces. Attempts to employ cruise missiles or ballistic missiles against mobile targets encounter a set of fundamental problems that undermine their potential both today and for the foreseeable future. In order to attack a mobile target, intelligence systems must first locate the target. Operators must then pass this information to nuclear forces, which in turn must be reprogrammed and then fired. This sequence takes time, during which the target in question may well have moved, and is highly susceptible to enemy action, particularly in a wartime environment. Breaking one link in the complex chain of events could defeat the capability to hold mobile enemy targets at risk. A penetrating bomber, on the other hand, combines surveillance systems and a person-in-the-loop with the capability to apply weapons immediately after locating a target--it thus inherently possesses a greater capability than cruise and ballistic missiles.

Cruise missiles have proven to be a valuable complement to the manned penetrating bomber force; they extend the lives of older bombers no longer capable of penetrating effectively, add mass to the bomber attack by saturating defenses, and are excellent weapons against many fixed targets. But these weapons are subject to operational constraints. For example, cruise missiles are of limited suitability for area targets, not effective against look-before-shoot targets, not capable of reacting to defenses and changes in the wartime environment, have limited targeting and routing flexibility, and present no threat to relocatable targets. In short, cruise missiles are pre-programmed robots that cannot offer the flexibility and efficiency created by the presence of a person in the loop.

A balanced combination of penetrating bombers and cruise missile carriers enhances deterrence by complicating the enemy defensive problem and adding targeting flexibility. But moving to a pure cruise missile bomber force, even in the absence of arms control constraints, would eliminate the advantages provided by penetrating bombers and introduce new vulnerabilities. A U.S. decision to restrict the bomber leg of the Triad to a pure cruise missile force would significantly ease the burden on Soviet air defenses. The Soviets could employ existing forces (interceptors, tankers, and airborne warning and control aircraft) to expand their air defense perimeter in operations aimed at destroying cruise missile carriers before they reached their launch points. Such a concept was employed by the United States Navy in the closing stages of World War II against a rocket-powered Japanese kamikaze missile called the Ohka. Ohkas were carried by bombers for launch from a standoff distance; in response, American fighters, cued by radar-equipped picket ships, shot down the bombers before they reached their launch points.

Using long-range radars and airborne radar platforms, Soviet air defenses could detect and track non-stealthy cruise missile carriers before these aircraft could launch their missiles, thus providing the Soviets with additional time and space to orchestrate outer and inner defenses. Such an approach would not work against a stealthy penetrating bomber. In addition, the Soviets could concentrate terminal defenses around high-value targets. Soviet military writings have discussed a variety of potential terminal defense concepts against both the ALCM and the stealthy Advanced Cruise Missile (ACM). These include: anti-aircraft barrage fire, deployment of radar corner reflectors and other items to confuse cruise missile guidance systems, and the jamming of cruise missile navigation systems. A cruise missile encountering such defenses cannot react; a manned penetrating bomber, employing tactical counters, jamming, chaff, flares, and defense suppression weapons, can.

By employing both survivable penetrating bombers and air launched cruise missiles, the U.S. gains a level of synergy and flexibility that enables it to adequately offset the intensive effort that the Soviets have made—and continue to make—in their air defense network. The Soviets will continue to be torn between orchestrating their interceptors, refuelers, and AWACs aircraft in far forward attacks on the cruise missile carriers and simultaneously marshalling other air defense assets and point defenses to deal with the different defensive problem posed by penetrating bombers and cruise missiles.

C. The Bomber and Conventional Operations

A prominent characteristic of the emerging global environment is uncertainty and instability. The likelihood that U.S. forces will be called upon at some time and place to defend U.S. interests is high—but now more than ever, the time and place are difficult to predict. As numbers of overseas bases and forward-based U.S. forces decline, global power projection capabilities will become increasingly important. The United States must place greater emphasis on systems that can operate from fewer locations, and at longer ranges. A flexible long-range bomber force, capable of rapidly and precisely delivering conventional ordnance against an enemy's most valued assets anywhere on the globe, can help prevent or delay potential escalation and achieve our national objectives over a wide range of conflict levels.

Neither ground- nor sea-launched ballistic missiles offer the bomber's equivalent flexibility in providing conventional capabilities. And in comparison to such assets traditionally associated with power projection—naval task forces and tactical aircraft—long-range bombers can deliver dramatic firepower to any location on the planet in a matter of hours. In the Vietnam War, B-52 sorties were flown from Guam, several thousand miles away from the scene; during the Falklands conflict, Britain operated Vulcan bombers many thousands of miles from friendly bases to conduct airbase attack and air defense suppression missions; in a Bright Star firepower display in 1983, B-52s operating from bases in the United States delivered conventional ordnance to a target range in Egypt. The bomber's range permits operations from secure bases, virtually independent of foreign basing and air space requirements in forward locations. It can autonomously deliver massive quantities of ordnance and/or conduct attacks with precision weapons, in day or night, and in all weather conditions.

This capability of immediate response, combined with global range and large payload capacity, makes long-range bombers extremely valuable assets not only for contingency operations, such as a Libya-style raid, but also for broader-scale theater operations involving larger force levels. In such conflicts, bombers can support theater commanders in a wide variety of conventional roles, including surface attack, defense suppression, mining, ship attack, and maritime surveillance. For example, B-52Gs today are configured to deliver a wide variety of ordnance: precision stand-off weapons (including the HAVE NAP weapon); almost 13 tons of general purpose and cluster bombs per aircraft; anti-ship mines; Harpoon anti-ship missiles; and, in future, Tacit Rainbow anti-radar drones for suppressing enemy air defense networks.

The Vietnam War witnessed the application of B-52s to conventional ground attack operations. As General William Westmoreland observed (and post-war statements from North Vietnamese confirmed): "...the B-52s became the weapon the enemy feared most. Flying so high they were beyond sight or hearing from the ground, they wedded surprise with devastating power." The long-range bombers provided a highly flexible means of rapidly delivering firepower to critical areas.

For example, if a higher priority target emerged in the course of mission, the B-52s routinely responded to change targets only a few minutes before delivering their ordnance. In the siege of Khe Sanh, B-52s played the key role in saving the sole American Marine regiment from being overrun by the two-plus enemy divisions laying the siege; B-52s flew over 2500 combat sorties to deliver over 150,000,000 pounds of ordnance. Delivering such quantities of firepower in such a short amount of time is something that cruise missiles and fighter aircraft simply cannot do. Some of the strikes around Khe Sanh were laid so precisely that the B-52s actually supplied close air support to the beleaguered American defenders. As Westmoreland noted: "The B-52s with their immense precision developed into the most lethal weapon employed in Vietnam...." In the 1972 Easter invasion, B-52s played a critical role in stopping thrusts by enemy mechanized forces. And at the close of 1972, B-52s did in eleven days what eleven years of fighting had failed to do—force the North Vietnamese to enter into serious cease-fire negotiations.

Land-based airpower has proven very effective in a variety of maritime roles. During World War II, air attacks accounted for the single largest cause of warships sunk. Land-based air accounted for 61 percent of those air attack sinkings, sea-based air making up the remaining 39 percent. In the Pacific, American bombers undertook mining missions that sank or damaged 670 Japanese ships and paralyzed Japanese commerce and military operations. As recounted by the Royal Navy's official history, Royal Air Force long-range aircraft laying mines proved more effective as destroyers of German shipping than any other force. German long-range aircraft savaged Allied convoys from the Mediterranean to above the Arctic circle. American and British long-range aircraft ranging over the Atlantic helped destroy Hitler's U-boat force as an effective weapon of war. Today, two B-52's can survey over 448,000 square miles of ocean while on a single standard maritime patrol sortie—an area the size of the South China Sea—and each can carry up to eight Harpoon anti-ship missiles to provide a formidable and rapidly deliverable combat punch.

III. THE CASE FOR THE B-2

The B-2 bomber has resulted from a conscious attempt by three successive administrations, representing both political parties, to ensure that the bomber leg of the Triad remains a viable deterrent in the face of expanding ground-to-air and air-to-air threats. Since 1965, the Soviets have invested over $400 billion to create a formidable integrated air defense system. It numbers 10,000 radars, more than 8,000 surface-to-air missile (SAMs) launchers, over 3,000 airborne interceptors and fighters, and growing numbers of tankers and airborne warning and control aircraft. By the mid-1990s, the Soviet homeland defense force will consist primarily of look-down shoot-down systems (that is, aircraft capable of detecting and engaging aircraft flying at low levels) such as the MiG-31 Foxhound and the SU-27 Flanker. New SAMs continue to replace older ones, giving the Soviets potential coverage from sea level to the fringes of the atmosphere against current U.S. systems. Just the Soviet yearly average production of surface-to-air missiles during the Gorbachev era—excluding man-portable SAMs—is staggering: 16,000 per year since 1986.

This threat also extends beyond the U.S.S.R. to other areas—the Persian Gulf, the Pacific, among others—where U.S. forces might be called upon to operate. The conflicts in these areas are likely to be "low" or "mid"-intensity struggles—but should not be confused with "low" or "mid"-level technology. Many of these nations possess competent and well-equipped military forces with increasingly sophisticated air defense systems.

Traditionally, the major nations—notably the Soviet Union, United States, France, Great Britain, and, more recently, the People's Republic of China—have exported weaponry at best only slightly less sophisticated than that fielded by their own military forces to Third World nations. During 1980-1988, for example, the U.S.S.R. delivered over 32,000 SAMs (again, exclusive of man-portable systems) and associated equipment to nations in the Americas, Asia, Africa, Europe, and the Middle East. Such exports can be expected to increase as the Soviets seek additional hard currency to bolster their faltering economy. Many of these developing nations have also produced quite sophisticated weapons of their own.

Modern fighter aircraft are also increasing in number and capability throughout the world. Even when excluding the United States, the Soviet Union, China, and the nations of Western and Eastern Europe, a count reveals over 9000 tactical fighters deployed around the world. The bulk of these fighters are from previous generations, but many have been upgraded with new avionics, radars, and weapons. Many nations, responding to regional tensions and threats, are modernizing with the latest generation equipment. MiG-29s, for example, are currently found in five Third World nations (Cuba, India, Iraq, North Korea, and Syria)—and several others (such as Algeria, Iran, Libya, Nigeria, Peru, and Zimbabwe) have expressed strong interest in purchasing this aircraft. Other relatively potent radar-equipped fighters are also found in the developing world—MiG-25s, Tornados, Mirage F.1Cs, Mirage 2000s, F-4s, and front-line U.S. equipment.

Combat operations in the last decade demonstrate the potential implications of the spread of advanced technology weapons. The Afghan war illustrated how small bands of guerillas firing sophisticated surface-to-air missiles could compromise the effectiveness of a first-rate air force should the latter prove unable to adapt tactically and technologically. The U.S. air strikes against Lebanon in the early 1980s and Libya during 1986's Operation Eldorado Canyon confronted dense Soviet-like air defense networks requiring sophisticated attack tactics and electronic countermeasures. The experience of the Royal Navy in the 1982 conflict with Argentina offers a sobering reminder of the destructiveness that modern high-technology weapons can inflict against "first world" forces—in this case, what is often referred to as the second-best navy in the world. Argentina possessed a total of six Exocet missiles and fired five. Three hit British ships (sinking two and severely damaging one vessel) and throughout the conflict, the Exocet threat played a dominant role in constraining British naval operations in the region.

The United States' future bomber force must be capable of operating in the face of these and other developing systems in both nuclear and conventional operations. The B-52 is already so constrained by advances in air defense technology that it is losing its viability as a penetrating bomber for deep strike missions; when flown over North Vietnam in 1972, B-52s operating at high altitude required concerted defense suppression operations to reduce their vulnerability to first-generation SAMs such as the SA-2. The B-1, whose design dates to the mid-1960s, will continue as a useful system for years to come. However, it too will be increasingly constrained by the evolving air defense threat environment, particularly in the post-2000 time period. The B-2, which incorporates stealth technologies to reduce its signature in a wide array of spectra, is the penetrating bomber of the future. It will become the cornerstone of the nation's long range bomber force.

Without the B-2, the bomber fleet will atrophy and bomber penetration capabilities will decline. Together, these events will lead to eventual disintegration of the balanced Triad concept. By the year 2000, for example, the force would deteriorate to less than 200 B-1 and B-52H bombers; almost half—the B-1s—will be 14 years old; the remaining aircraft—the B-52s—will be at least 40 years old. By that time it will have been 55 years since Air Force planners first envisioned the B-52, and almost 40 years since they envisioned the B-1. To put this in perspective, the Air Force could have B-52 crews whose grandfathers flew the airplane. Eventually the force would shrink to only the B-1, thus effectively ending the era of the balanced Triad, particularly as the B-1's capability to penetrate Soviet air defenses is eroded. Our deterrent capability would degrade as U.S. forces lose the penetrating bomber's flexibility and efficiency in delivering nuclear weapons. And reliance solely on non-stealthy cruise missile carriers would degrade effectiveness and open new vulnerabilities.

The B-2 enjoys important advantages over existing bombers, which stem from a revolutionary blending of stealth technologies in a large aircraft with high aerodynamic efficiency and large payload capacity. The B-2's higher survivability enables it to fly at higher altitudes to provide a better field of view for the crew and the aircraft sensor suite. Its low observability allows more flexible routing—driven by mission requirements rather than the threat. Other types of bombers will be restricted to operating at low altitudes with limited sensor field of view under strict routing restrictions and stringent fuel limits. In combination, the B-2's enhanced survivability and high aerodynamic efficiency for greater range and search time will provide the baseline aircraft with greater capabilities against a wider variety of targets than existing bombers. Built-in potential for improvements can provide even greater capability in the future.

As a viable penetrator, the B-2 will work synergistically to improve the capabilities of the air-breathing force as a whole. As the B-2 attacks the most heavily defended Soviet targets, the B-1 will be able to concentrate on penetrating to less heavily defended targets, and the B-52 force, equipped with ALCMs and the ACMs, can conduct standoff attacks. This employment of the bomber force, in which each type of bomber attacks the most suitable targets, enhances the

survivability and effectiveness of the bomber force as a whole to reinforce our deterrent potential.

In the conventional role, the B-2 is a formidable weapon. Its stealth characteristics make defense against such a bomber extremely difficult, while its long-range and high payload ensure that any adversary would remain vulnerable. In short, its very existence could deter aggressors from threatening the security of the United States and allied nations around the world. The B-2 can penetrate to any location on the planet to deliver massive quantities of ordnance precisely. Like the B-52 and B-1B, it can be configured to meet the changing needs of U.S. national security—stealth characteristics provide it with important survivability advantages over these older bombers. But a failure to build the B-2 would force dependence over time on the existing fleet of 97 B-1's, which in turn would become a much more critical component of the Triad. In Vietnam, the United States was able to employ over 200 front-line B-52s against Vietnam because over 200 other bombers were available to maintain nuclear deterrence.

For both nuclear and conventional deterrence, the flexible penetrating bomber offers a range of unique capabilities. For missions into high threat environments that will exist in the twenty-first century, only the stealthy B-2 can be expected to meet the Nation's most demanding and critical needs. To demonstrate that the B-2 is the most effective method of modernizing the bomber force requires addressing a number of key issues: stealth and counter-stealth, risk reduction and testing, deployment and safety, and cost.

A. Stealth and Counter-Stealth

"Stealth" is a popular name for a group of technologies more precisely termed "low observables." They involve efforts to actively reduce the observable "signatures" of an aircraft in the electromagnetic, optical, thermal, and acoustic environments. The term stealth, however, has come to be associated primarily with radar cross-section (RCS) reduction. First applied in rudimentary fashion to the Lockheed SR-71 strategic reconnaissance aircraft, "stealth" has grown steadily more sophisticated through the years. In fact, its origins date to the early years of the Second World War, when British radar technicians first examined the potentiality of "radar camouflaging" aircraft to evade detection; subsequently, German engineers applied primitive radar-absorbent coatings to submarine *schnorkel* breathing tubes so that Allied search radars could not detect them. Stealth as a concept is nearly a half-century old. But it was not until the emergence of the Lockheed F-117 fighter that aerospace technology succeeded in creating a military aircraft that had a truly profound reduction in radar cross-section, and, hence, in radar "signature."

Stealth not only protects an aircraft (defense), but greatly enhances the aircraft's likelihood of prosecuting a successful strike (offense). It enables the attacker to slip in around the most critical defenses of an opponent, and get so close to a target before finally (possibly) being detected that there is little chance of thwarting the attack. It reduces the effective range of an adversary's defenses to the point where they are essentially nullified. Stealth thus provides a revolutionary force-multiplying combat leverage.

It must be stressed that stealth does not render an airplane "invisible," nor is it intended that it do so. Rather, by a variety of means—including configuration shaping, coatings, absorbers, and structural materials—the probing effectiveness of radar and other sensors can be greatly reduced. The actual technical levels to which stealth can now be applied is highly classified. Suffice it to say, the B-2 will virtually negate the multi-billion dollar investment that the Soviet Union has made in its air defense network. Now and into the forecastable future, the B-2 will be able to operate with near impunity in any conceivable threat environment.

The United States Air Force has possessed this leverage with operational aircraft ready to strike since late 1983—nearly seven years. No other revolutionary military technology in recent times has remained so exclusively the province of one nation—not radar, not atomic and nuclear weapons, not jet propulsion and supersonic aircraft, not ICBMs. The "fourth-generation" stealth technology[1] available with the B-2 promises to extend this exclusive American mandate even further, and carry it onwards into the 21st Century.

To understand how stealth works, it is necessary to briefly review how air defense systems operate. Virtually all air defense systems rely on radar as the primary sensor. The use of radar and radar-directed weapons such as air-to-air or surface-to-air missiles and antiaircraft gunfire involves three inter-related functions:

- *Surveillance*: searching a broad volume of air space to locate the target;
- *Fire control*: establishing the target's current and future position, identifying whether it is friendly or hostile, and guiding some type of weapon to the immediate vicinity;
- *Kill*: bringing a weapon close enough to the target to allow the weapon's fuse to detect the target and then fire the warhead within lethal range.

Capable air defense systems must be able to carry out all three main functions reliably against all potential threats—if one function is done poorly, the net overall effectiveness is very low. Moreover, the air defense system must be able to survive direct attacks, resist countermeasures and adversary tactics, and function in the full range of atmospheric conditions.

Stealth aircraft dramatically reduce the effectiveness of all three basic air defense functions—surveillance, fire control, and kill—to enjoy greatly enhanced survivability. While a stealth aircraft may possibly be illuminated by a search radar, the radar is typically unable to "dwell" on the aircraft and thus determine a firm fix, flight path, position, speed, and altitude. Stealth aircraft are difficult to track. Fusing of radar-guided missiles against stealthy targets is also extremely

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[1] The four generations include:

- First generation (SR-71, B-1B) : stealthy coatings and materials
- Second generation (Advanced Cruise Missile) : small stealthy unmanned platforms
- Third generation (F-117): stealthy manned platforms but with range/payload performance tradeoffs
- Fourth generation (B-2): large stealthy manned, high performance platforms

difficult. In short, the ability to detect the possible presence of a stealth aircraft does not automatically equate to an ability to attack and destroy it.

The greatest threat to conventional penetrating aircraft today are airborne defenses that combine airborne early warning aircraft and look-down, shoot-down fighters. The location of these defenses at any moment in time is unpredictable, making evasive routing difficult. But since physical constraints prevent the installation of larger antennas and transmitters on airborne platforms and air-to-air missiles, the B-2's stealth technology largely eliminates these systems as potential threats.

Ground-based radars and missiles are less constrained by physical size and power limitations than airborne systems and, provided an opponent is willing to expend vast sums, can be upgraded to possess a limited detection capability. But the shrinking of radar detection and engagement radii created by stealth technologies still poses a defender with insurmountable problems. Even against upgraded systems the B-2 can evade enemy air defense networks using stealth, tactics, and other counter-measures. This is something that the B-1 cannot be expected to do by the turn of the century.

The Air Force has repeatedly acknowledged that the B-2 is not "invisible" and that systems and techniques do exist which can sometimes detect it, but field tests, calculations, and computer models have demonstrated that the bomber's survivability is not seriously threatened by such fleeting detections. To defend against the B-2 and other stealthy platforms, an adversary must address additional questions. Will the detection system provide suitable coverage to defend a large enough area? Will it do so for all altitudes and flight profiles? How susceptible is it to counter-measures? Can the system maintain accurate dwell and track for sufficient time? Can this track be used to direct a combat system to engage the stealth target with sufficient capability to threaten it? And finally, if the stealthy target can be successfully fired upon by a radar-guided missile system, is the missile likely to fuse properly?

While the exact anticipated effectiveness of the B-2 against the range of potential adversary air defense systems is classified, it can be stated that since the late 1970s, during the development of the F-117, the Air Force and Department of Defense have worked assiduously to identify weaknesses in the stealth approach that could be exploited by a potential foe. This has included undertaking an extensive, independent "counter-stealth" team effort supported by highly qualified engineers and scientists investigating all means for countering stealth technologies. The goal has been to find the "Achilles' heel" which would negate the value of these technologies. Both conventional and unconventional defense systems have been explored; in the latter area, over 40 different concepts proposed to defeat stealth have been evaluated—and none have proven viable challenges to stealth.[1]

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[1] Some of the concepts evaluated included: Acoustic Systems, Bi-static Radar Systems, Infrared Detection Schemes, Corona Discharge Detection, Interaction with Cosmic Rays, Passive Coherent Detection Schemes, Radar Shadow Detection, Land Mines, Magnetic Disturbance Detection, Hybrid Bi-static Space Radar, High Frequency Surface Wave Radar, Detection of Aircraft Emissions, Radiometric Detection, Air Vehicle Aerodynamic Wake Detection, and Ultra Wideband (Impulse) Radar.

Submarines offer a useful example to guide our thinking about stealth platforms and counter-stealth defenses. Submarines depend almost totally on stealth for survival. Both the United States and the Soviet Union continue to rely on these underwater craft for critical missions and concurrently invest heavily in a counter-stealth program—anti-submarine warfare (ASW). But the existence of these ASW programs does not draw into question the commitment of either side to submarines. They can be detected, but the difficulties involved do not seriously threaten the capabilities of submarines to execute assigned missions. Indeed, decades of intensive research and the expenditure of billions of dollars have not produced any simple and inexpensive method to compromise the submarine's stealthy nature.

The U.S. counter-stealth program supports two objectives. First, we cannot expect that the Soviet Union or other nations will allow the United States to remain the sole practitioner of these technologies—we must be prepared to deal with attacks in future by stealthy anti-ship missiles, cruise missiles, and aircraft. Second, the counter-stealth program performs a useful function as the final audit on B-2 and other stealth aircraft survivability assessments. If the counter-stealth effort developed an effective means of defending against stealth aircraft, then the B-2 survivability assessment program would be suspect. If, on the other hand, the counter-stealth team was unable to develop solutions, even employing exotic and expensive technologies in developing approaches, B-2 survivability assessments are valid. The latter is the case today—the counter-stealth program is finding no effective, affordable method to defeat stealth.

B. Risk Reduction and Testing

Since 1945, aerospace technology has experienced four major revolutions: the turbojet revolution, the supersonic breakthrough, the electronic revolution, and the maturation of the design and materials capabilities needed to pursue very low observability. Along the way, American military aircraft have adapted and, indeed, embraced these revolutions. The B-2 benefits from aspects of these technologies and draws on an earlier heritage of flying wing development as well, a heritage dating back to 1912. Achieving the kind of capabilities that we expect from the B-2 would not have been possible prior to the maturation of the above four revolutions. In fact, it has been said that the B-2, like the F-16, is less an airplane than a computer: you don't turn it on, you boot it up. More than 200 on-board computers run about 2 million lines of code. Prior to the B-2, bombers were designed first for aerodynamic and propulsive performance, and only secondarily for reduced observables—reduced radar, infrared, optical, and acoustic "signatures." The B-2 is revolutionary in that it is the first bomber ever developed that combined all-aspect, all-spectrum low-observability with high performance (i.e., long range and high payload). This itself made the design process extraordinarily complex, for literally every external line of the aircraft had to be evaluated for its impact upon the craft's anticipated signature as well as its performance. The experience of the earlier F-117 "stealth fighter" proved useful, but the B-2 used a significantly different approach than the F-117.

Overall, what was most beneficial was less the technical lessons of the F-117 and more the fact that key B-2 decision-makers—including the program director—had extensive experience in dealing with the entire "stealth" field in general and the F-117 in particular. The B-2 greatly benefitted from the development of electronic flight control systems pioneered on the F-16 fighter. Finally, the development history of the B-1 offered many direct lessons—and warnings—for the subsequent development of the B-2. The interchange of information between the B-2 and B-1 communities, and the incorporation of many B-1 "veterans," from engineers through test pilots, into the B-2 at an early stage ensured that the B-2 research, development, test, and evaluation effort was best able to take advantage of the lessons learned on the B-1 program. In addition, the acquisition of the B-1B provided a valuable breathing space in which to mature and develop the set of new technologies, materials, and processes needed to build a bomber like the B-2.

Wherever possible, Air Force and contractor personnel followed a risk reduction philosophy that employed extensive ground and laboratory studies before significant design or manufacturing decisions. For example, in the eight years between contract signing and first flight, the government-industry B-2 team actively sought to reduce risk in ten key areas: observable signatures, configuration (shape), inlet/exhaust design, low altitude ride quality, avionics, nuclear "hardness" (to withstand electromagnetic pulse—EMP—effects), engine development, design of the composite-structure wing, manufacturing technology, and threat assessment. Only after the most thorough review of design solutions in each of these areas was the program allowed to continue to fabrication and first flight.

An aircraft design is useless unless it can be manufactured expeditiously and to a reliable consistency. In the case of the B-2, this requirement is even more severe: every B-2 has to be finished to an exacting standard so that its vital radar signature—and other "low observable"—requirements are met. The biggest challenge the B-2 has faced in a manufacturing sense has been the challenge of ensuring that this craft—a large tailless flying wing with smooth surface contour development and unbroken mold lines—could actually be built in quantity. In contrast, the early F-117 was virtually a hand-built aircraft, an approach that could not be taken for the B-2. When the contract for the B-2 was awarded, the kind of precision tooling, fabrication, and manufacturing capabilities required for the B-2 didn't even exist. Subsequently, hundreds of whole new processes and new materials had to be developed for the B-2.

Fortunately, the B-2 was able to benefit from two aspects of the electronic revolution: computer aided design and computer aided manufacturing (CAD/CAM). A powerful three-dimensional computer data base reduced costs and compressed development time. CAD/CAM resulted in the B-2 having a seventeen-fold improvement in the manufacture of contoured structures, a six-fold reduction in "first-part fit" errors, and an incredible 97% success rate for first-fit of tubing, fluid, and mechanical systems, compared to a previous industry-wide "best" standard of 60%. The first B-2 airframe only required a small number of changes—a dramatic reduction compared to other civil and military aircraft. The confidence of using CAD/CAM enabled Northrop to build the first aircraft on production tooling—a first in the design and development of high-technology military aircraft.

The B-2 employs composite structures extensively, which play a key role in its stealth capabilities. Compared to regular materials, the use of composites also permitted a significant reduction in weight—at least 5,000 pounds—because flight path loads could be tailored. Contrary to popular belief, composites are extremely durable and damage resistant. LTV, Boeing, and Northrop have successfully been producing composite pieces for the B-2. For example, Northrop's composite center manufactures these composite products with less than four percent scrap, rework, or repair. Perhaps most remarkably, the manufacturing learning curve is such that the third B-2 will require only about 50% of the manufacturing hours of the first, and by the time of the eleventh B-2, manufacturing hours per aircraft will have dropped to but 30% of the first vehicle.

When compared to other military and civilian aircraft in terms of manufacturing hours per pound of aircraft structure (a standard aerospace industry measure of complexity), the B-2 is in the same category as the commercial Boeing 757 and 767 jetliners, and much less than the B-1B and B-58 bombers, or even the F-15, F-16, and F-111 fighters. Clearly, then, as challenging as the B-2 is, it is not so complex as to be "undoable."

At some point in every aircraft development process, a "moment of truth" arrives as the aircraft sits at the end of a runway, poised for its first flight. Before the B-2 lifted into the air on its maiden flight on July 17, 1989, it was the most tested aircraft in aviation history. Testing the B-2 covered a range of issues related to flight safety and anticipated aircraft performance, the latter being both "traditional" (such as expected speed, range, and payload, for example) and "nontraditional" (such as anticipated RCS and other signatures). By the time the B-2 made its first flight, it's systems and components had undergone over 550,000 hours of testing. The B-2 had already accumulated 24,000 hours of wind tunnel testing (more than any other subsonic airplane), 44,000 hours of avionics testing (indeed, as early as the mid-1980s, a C-135 avionics testbed had flown as a "dedicated" B-2 radar development aircraft), and its flight control system had undergone 6,000 hours of simulator test and evaluation by Air Force and Northrop test pilots and engineers. Computer systems testing consumed 122,000 hours, flight qualification testing took 291,000 hours, and acceptance testing took another 67,000 hours. Over 100,000 RCS images of the B-2 and its components were taken and analyzed to refine understanding and design of its low observable characteristics.

Structurally, CAD/CAM enabled extremely accurate prediction of the composite structure's integrity. During structural testing, the B-2's wing section was deliberately tested to the failure point. It failed at 1.8 times its design limit—better than the 1.7 predicted. This itself was noteworthy—the first time that a large complex composite structural element had exceeded its anticipated design goals during an initial stress test. Experiences such as this have demonstrated that the extensive risk reduction efforts undertaken by the government-industry B-2 team have worked, and have generated confidence that other predictions—such as RCS characteristics—will be met or bettered as well. Even before its first flight, its General Electric F118 engines were so thoroughly tested as to be already production-qualified—an unprecedented "first" for military aircraft.[1]

So well-thought-out and proven was this aircraft that when it began its flight test program, Northrop and Air Force test pilots discovered that it actually flew better than its simulator. This 172 ft-span, over 370,000 lb. airplane handled like a fighter—agile, responsive, and precise—in contrast to the traditional handling qualities of large aircraft.[2] In its first flight, the B-2 flew for a full hour and 53 minutes, stable, easy to control, and without any anomalies, attaining all its test objectives. Subsequent flight testing, including air refueling trials with a KC-10 tanker, has gone equally well, leading to strong confidence that the B-2 is an extraordinarily fine airplane.

C. Deployment and Safety

The long track record of Strategic Air Command in operating successive generations of advanced strategic bombers—from the B-29 and its evolutionary successor, the B-50, to the jet-and-prop B-36, and then to the successive types of all-jet bombers—give a high level of confidence that the B-2 will experience a smooth introduction into service. Further enhancing confidence in its timely introduction to service has been a conscious policy of integrating Air Force Systems Command, Air Force Logistics Command, Air Training Command, Strategic Air Command, and Northrop personnel into virtually all aspects of B-2 research, development, test, and evaluation, including "hands-on" experience in maintenance during flight tests of the first aircraft.

This is not a case of developing a weapon and then handing it to the using command to find out if it can operate the aircraft. The development of the B-2 has been a true exercise in integrated teamwork across several commands, with emphasis on a total quality management approach that stresses forthrightness, team effort, and frank resolution of all areas of concern. The experience of the Tactical Air Command with the F-117A provides historical evidence that a stealth aircraft can be rapidly introduced into the operational inventory of a combat command. The B-2, a fourth-generation stealth system, can be anticipated to better the excellent record of its stealth fighter predecessor.

The B-2 has been the subject of occasional questions about its safety, largely because of its all-wing configuration. Critics have pointed to the loss of the Northrop YB-49A flying wing in 1948 as a potential reason for delaying or even cancelling a program undertaken forty years later using the results of four technical revolutions that had not been fulfilled or, in some cases, even dreamed of, when that earlier immature airplane flew. Some feared the B-2 might lack stability because it was a flying wing—thus it allegedly lacks the inherent stability of a "tailed" airplane. Computer controlled flight controls have long since eliminated such problems. For example, the F-16, a conventional-appearing aircraft, is dynamically unstable and cannot be flown without its fly-by-wire flight controls. Flying wings, in fact, are typically inherently stable craft—as is the B-2 itself. Indeed, the earliest examples of flying wings—the tailless flying wing biplanes and monoplanes of J. W. Dunne (flown in 1912), G. T. R. Hill (the 1920s), the Horten brothers and Alexander Lippisch (the 1930s) and John Northrop (the 1930s and 1940s) were all very controllable machines—and this well in advance of the electronic flight control era.

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[1] Engine-airframe matching was a serious problem in previous military aircraft programs throughout the 1940s and 1950s, and on into the 1960s with the F-111 and the Lockheed A-12. Even in the 1970s, the F-15 and F-16 experienced some developmental difficulties because of problems with their engines.

[2] One of the reasons the B-2 handles like a fighter is that the composite materials give it far more rigidity than an aircraft like the B-52. In particular, the amount of flex at the ends of the wingtips is much lower. With the B-52, for example, the wingtips can flex through an amazing arc of 32 feet, making it impossible to get fighter-like responsiveness from such an aircraft.

The advent of electronic flight control system technology, an outgrowth of the development of stability augmentation technology in the 1950s coupled with advances in airborne computers made possible by the space program of the 1960s, considerably enhanced the potential and actual performance of the B-2. The B-2 proved its critics wrong with its first flight. To ensure that the B-2 flight control system is as safe as possible, it utilizes a quad-redundant system much like the Space Shuttle's flight control system. The four computers "vote" whenever a decision is made, and, in the extremely unlikely event that a catastrophic software "bug" would simultaneously affect all four programs, the B-2 incorporates a separate software package prepared by a different team of programmers as a "back-up." To allow for future contingencies, the B-2 has a built-in 40% reserve in memory and processing capability to allow for growth once the plane is in service. Safety is intrinsically tied to risk-reduction. The risk-reduction effort to this point has been extraordinary, as the number of hours devoted to testing clearly indicates. That same approach, carried forward during subsequent testing and into operational service, will ensure that the B-2 program continues successfully.

D. Cost

The B-2 is an expensive weapon system. The preceding pages have provided an illustration of its value to U.S. national security, but because it has drawn such critical attention and comment, cost has emerged as one of the most important issues in determining whether or not the B-2 program goes forward.

The B-2 is certainly not the most expensive weapon system under consideration. Currently, on a cost-to-complete basis for the planned 75 aircraft force, the program is only the seventh largest compared to other ongoing DoD programs. On a per unit basis B-2 costs are comparable with other systems. For example, on a "flyaway" or "sailaway" basis—the cost to build a weapon system after the expenditure of research and development funds—the revolutionary B-2 (for a buy of 75 aircraft) costs about the same as a naval frigate (almost 100 of which are currently in service). These systems have differing capabilities and uses—a B-2, for example, would be of limited utility for anti-submarine operations, just as a frigate could not deliver massive quantities of ordnance thousands of miles away. Each system's value must be judged on the basis of its contribution to U.S. national security, not just on cost.

Typically, bomber funding follows a cyclical pattern; there is a sharp increase (a "ramp") in funding required during bomber development and

procurement, followed by a long "plateau" period during which the previously acquired system is in service—in sum, periodic investment is followed by a long lasting payback in deterrence. This pattern was followed over the past five decades with the B-36, the B-47, the B-52, the FB-111, and the B-1; now, it is the pattern being followed with the B-2.

Aircraft costs are expressed in differing ways. Acquisition or program cost includes money spent on research and development, the cost to build the aircraft, the procurement of initial spares and support equipment, technical orders, and initial training. Flyaway cost is the cost to manufacture the aircraft and provide other associated items, such as quality assurance, government-supplied equipment, and warranties.

In addition, a variety of different dollar values are employed in these categories. Base year dollars (BY $) reflect cost with inflation removed in constant year dollars (typically the year in which the program started). Current year dollars (CY $) shows cost in today's dollars. Then year dollars (TY $) show weapon system cost based on the years when funds are actually spent. The cost of programs procured in future years are increased by projected inflation rates. The latter are normally the highest estimates. For example, if inflation rates are projected to run at 4% annually, compounded over 20 years (not an unusually long development and deployment period for major weapon systems), this will more than double any price or cost expressed in then year dollars. Using these criteria, the following table illustrates the cost of each B-2 based on the current 75 aircraft buy and the previously planned 132 aircraft buy:

Table 1: B-2 Cost per aircraft (millions of dollars)

	Base Year Dollars (1981)		Current Year Dollars (1990)		Then Year Dollars	
# of Aircraft	75	132	75	132	75	132
Program or Acquisition Cost	495	337	752	516	814	573
Flyaway Cost	265	184	417	290	492	345

Note: Cost data for the 75 aircraft force was derived from the Secretary of Defense's recent Major Aircraft Review.

Critics of the B-2 tend to focus on program unit cost in then year dollars. But concentrating on unit program cost fails to consider the revolutionary advancements in new technologies, materials, and processes being made by the B-2 program, such as stealth technologies, aerodynamics, three dimensional design and development, highly automated manufacturing processes, and large composite structural materials, to name a few. Many of the advancements in this partial list will benefit the U.S. industrial manufacturing sector for many years to come. And in the future, no U.S. military or civilian aircraft will be designed without reference to the technologies, manufacturing processes, design capabilities, and other advancements that were pioneered on the B-2. Research

and development money spent on the B-2 has expanded the United States' significant lead not only in stealth technology, but in *aerospace* technology.

Once development ends, program cost is primarily of historic interest. This is particularly true in the case of the B-2. Since more than forty percent of the total program cost has already been expended, making decisions on the basis of total program cost is of limited value. An appropriate analogy is found in manufacturing. Compare the current status of the B-2 with the design and production of a new product. In the case of the B-2, we have conducted initial research and development, initiated and completed design work, created the required tooling to produce the machines, conducted extensive testing, and have produced test articles which are proving highly successful. We are on the verge of production. In other words, all that is left to do is to capitalize on this investment and produce the vehicles. Now is the time to reap the benefits of these years of research, development, and progress in technology. We must focus on what is left to be spent—not what has been spent—to capitalize on this investment.

The flyaway cost of the B-2 bomber is currently $417 million (FY90 $) per aircraft; under the previously planned purchase of 132 aircraft, the cost per unit would have stood at $290 million (FY90 $). The increase in cost stems from a significantly lower total production run and reductions in procurement rates. At first, this seems an extraordinarily large number. But some comparisons are in order.

For example, does the B-2 program consume an abnormally large average percentage of the Department of Defense (DoD) budget compared to other bomber programs? From 1952-61, the B-52 consumed 1.4% on average of the DoD's budget; from 1982-86, the B-1B took up 1.6%. Under the 132 aircraft plan, the B-2 was anticipated to take up 1.3% of the DoD budget over the 1987-1997 period; the reduction in the number of aircraft procured will reduce this average amount to 1.1% of the budget. In other words, the B-2 consumes a significantly smaller annual proportion of the defense budget than previous bombers.

The historical pattern shows that each generation of aircraft has been significantly more expensive than the previous, reflecting advances in technology and capabilities. Under the original 132 aircraft program, each B-2 in terms of flyaway cost would have cost 20% more than the much less capable B-1B; under the revised program, each B-2 will cost 80% more. But this is a much smaller cost increase than has been seen in earlier programs. For example, the B-36 cost nearly seven times the price of the B-29, America's first atomic bomber, the B-52 cost nearly three times that of the B-36, and the B-1B cost more than three times the price of the B-52.

Another way to examine the historical evolution of bomber costs is to compare the flyaway costs of bombers to contemporary fighters. Does the B-2 exist within the established cost pattern of bomber vs. fighter costs or does it exceed it? The B-29A cost 1,200% more than its technological equivalent, the P-51D fighter. The B-36H cost 2,000% more than the contemporary F-86F. The B-52H cost 1,300% more than the contemporary F-100D. The B-58 cost 700% more than the F-104A; the B-1B and a contemporary fighter such as the F-15E feature a similar relationship. That cost relationship will remain approximately the same when comparing the B-2 and such equivalent technology fighters as the Navy's A-12 and the Air Force's Advanced Tactical Aircraft and Advanced Tactical Fighter. Historically, then, the B-2 is not out of line with respect to other American bomber efforts. Indeed, it betters many other bomber development programs in terms of its cost relationship to other military systems, and is firmly in the mainstream of bomber-fighter relationships.

The best way to think about costs is to focus on what we can affect from today forward. Through the FY 90 budget, $26.7 billion (TY $) has already been committed to the B-2 program, which includes procurement funds for 10 aircraft. To complete development, testing, and refurbishment of the five full scale development aircraft in order to deliver the total of 15 aircraft would require another $8.7 billion (TY $).[1] This is what opponents who recommend "killing" the B-2 are proposing after completion of the aircraft under contract—to invest $35.4 billion (TY $) for almost no combat capability. Under the Secretary of Defense's proposal to acquire a total of 75 B-2s, the additional 60 aircraft would require an incremental investment of $25.7 billion (TY $). These latter figures are the most relevant measures of the resource commitments proposed by the the Secretary of Defense and the Air Force for the B-2 from future defense budgets.

In the final analysis, is the B-2 too expensive to use in operations besides nuclear combat? The historical record indicates that we have never considered cost an issue in war. Rather, we have always opted to use the best possible weapon for getting the mission accomplished, with the least risk to our crews. To those ends, we employed the B-29 in World War II and Korea, the B-52 in Vietnam, the F-111 in Libya, and the F-117 in Panama. Despite being a scarce and expensive system, the SR-71 strategic reconnaissance aircraft—the most expensive operational aircraft of its time—was routinely flown with high confidence into high-threat areas until its retirement earlier this year. The costs of the SR-71 were due in large part to its unique capabilities, which in turn conferred a high degree of survivability. The B-2 is no exception. Indeed, we routinely send more expensive systems manned by large numbers of crewmen—naval ships—in "harm's way." We do so because the job needs to be done and because we have high confidence in the survivability of our modern systems. The B-2 offers exceptionally high survivability while risking very little American blood. Moreover, there may be targets that only the B-2 can attack with high confidence. Therefore, there is every reason to believe that future decision-makers would choose to use the B-2 for any mission for which it was the appropriate choice.

IV. CONCLUSIONS

The need for the B-2 is real. It has not been mere technological fascination that has led successive Democratic and Republican Administrations and Congresses to enthusiastically support the evolution of stealth technology, the deployment of a stealth fighter, and now the development and anticipated deployment of the B-2 bomber. Rather, it has been the cold, pragmatic recognition that stealth technology is among the most significant military technologies to appear since the advent of radar and the atomic bomb—and one in which the United States enjoys an unprecedented lead.

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[1] The cost to go includes the cost of completing the test program ($5.1 billion in TY $) and all costs associated with curtailment of production activity ($3.6 billion in TY $).

The B-2's exploitation of stealth technology will enable it to remain a viable penetrating bomber for the foreseeable future. The development of materials, design capabilities, and manufacturing techniques for the B-2 have provided the United States with an unprecedented lead in the revolutionary set of stealth technologies. The stealthy B-2 will become the backbone of the bomber fleet—and thus provide U.S. national security with the stabilizing, deterring, and flexible capabilities of bombers for the long term.

The bomber enhances the stability of the nuclear balance through its capabilities as a flexible means of sending signals in a crisis, its high survivability, and its relatively slow speed when compared to ballistic missiles. The penetrating bomber enhances nuclear deterrence through its efficiencies in delivering the most powerful nuclear weapons against the entire range of the key elements of an adversary's power, its capabilities to assess whether sites have useful targets present, and its synergistic relationship with cruise missile carriers that enhances the effectiveness of the air breathing force as a whole. The bomber's unique flexibility in projecting conventional power will become even more vital in these times of instability, uncertainty, and rapid change. The long-range bomber employing conventional weapons can deter, deliver a tailored response, or punch with devastating power if required in a wide variety of roles. Indeed, the bomber is one of the nation's premier power projection assets.

The bomber, and the survivable penetrating bomber in particular, is a flexible weapon that can be adapted to meet the changing needs of U.S. national security policy. The most effective method of maintaining the viability of the bomber force is to procure the B-2. It is a costly weapon, but an essential one. The Air Force's plan for the 1990s, "The United States Air Force and U.S. National Security: Global Reach—Global Power," capitalizes upon the inherent characteristics of airpower: speed, range, flexibility, precision, and lethality. The B-2 in many ways epitomizes airpower's inherent attributes—it provides true global reach and deterring global power.

B-2 SURVIVABILITY AGAINST AIR DEFENSE SYSTEMS

I. INTRODUCTION

Incorporating "stealth" technologies that reduce its signature in a wide array of spectra, the B-2 now stands poised to enter operational service within the next few years as the cornerstone of the Air Force's modernized bomber fleet. The military value of the B-2 hinges directly on the survivability provided by its stealth capabilities. The purpose of this paper is to provide interested readers with an unclassified overview of the B-2's current and long-term survivability when penetrating air defense systems--an issue that has become the subject of much misinformed controversy.

B-2 survivability raises many complex technical topics that directly affect the lives of U.S. aircrews--accordingly, some details relating to survivability must remain classified. Despite this limitation, this paper discusses the technical and operational issues involved in air defense against stealthy aircraft to provide an informed and accurate unclassified assessment of B-2 survivability. Because this discussion is unclassified, the presentation of quantitative results is severely limited, and some questions are necessarily addressed by assertions that these concerns have been investigated and satisfactory answers obtained.

This paper begins with a short general discussion on stealth and counter-stealth activities. The main sections of the paper then analyze the capabilities of conventional and unconventional air defense systems to defend against stealth aircraft. The paper then concludes with a short commentary on the value of a vigorous U.S. program in counter-stealth air defense approaches.

II. THINKING ABOUT STEALTH AND COUNTER-STEALTH

Maintaining a viable military capability in any particular area typically involves an action-reaction sequence. Submarines offer a useful, long-standing example to guide our thinking about stealth platforms, counter-stealth defenses, and the action-reaction cycle.[1] Modern nuclear submarines depend almost totally on stealth for survival. The United States has deployed these types of submarines for many years and has devoted substantial financial resources to their development, procurement, operation, and improvement. Concurrently, we have invested substantial effort and resources in a counter-stealth activity--anti-submarine warfare (ASW). The Soviets also field many submarines and aggressively pursue substantial ASW activities.

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[1] Interestingly, the history of the action-reaction cycle involving submarines features the first use of stealth technology to defeat radars. During World War II, the Allies severely degraded German U-boat activities by employing land-based, long range maritime patrol aircraft to catch U-boats operating on the surface while recharging their batteries. In response, the *Kriegsmarine* developed the snorkel, an apparatus

Soviet ASW activities do not seriously question the U.S. commitment to submarines, which we continue to rely on for many vital military capabilities. Nor does the vigorous U.S. ASW program provide a reason to question our commitment to submarines. U.S. policy instead strives for substantial superiority over the Soviet Union and other nations in submarine and ASW technologies and capabilities--an approach that has served the United States very well for many decades.

In the case of the B-2 and other stealthy aircraft, we have a dramatic lead in this particular set of technologies and the potential to sustain that lead for many years. At the same time, we are aggressively pursuing counter-stealth air defense programs because--as with the case of submarines--it is reasonable to assume that potential adversaries will quickly recognize the benefits of stealth aircraft and begin fielding such systems in future decades.

Developing an informed and mature view of the survivability of stealthy aircraft is necessary as we pursue these stealth and counter-stealth activities. For example, during test activities, air defense sensor components will occasionally detect stealthy air vehicles, and, with sufficient coverage density and at short ranges, perhaps even track them for short periods of time. But this by itself is not a cause to question our commitment to stealth. What is important is the quantitative extent of the detection or short duration tracking and the "real world" effectiveness of potential defense systems that employ this detection or tracking to defend against a stealthy target.

In the case of submarines, no one suggests that a 560 foot long, 17,000 ton metallic object is "invisible" even under water. Similarly, no one argues that the 170 foot wingspan, 350,000 pound B-2 is "invisible" as it passes overhead at low altitude. What can convincingly be argued and supported by tests, however, is that neither the submarine nor the B-2 can be *consistently* detected, tracked, or engaged at military useful ranges in typical operational scenarios--in short, both types of systems are highly

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which permitted a submarine to use its diesel engines for battery recharging while cruising underwater. The Allies in turn developed air-borne radars which could detect the snorkel. To counter this threat, the Germans developed and installed a rubbery coating over the snorkel which degraded the effectiveness of allied radars.

survivable. This paper provides evidence to support this survivability assessment of the B-2 bomber.

III. STEALTH SURVIVABILITY INVESTIGATIONS

Since the early days of the stealth program, the Air Force has conducted, and continues to conduct a broad range of investigations of potential air defense counters to stealthy air vehicles. These ongoing studies have explored the capabilities of potential air defenses against a wide range of air vehicles (such as cruise missiles, fighters, and bombers) with the objective of finding an "Achilles' heel" that could provide a means to effectively counter stealth technologies. A talented cadre of Ph.D. level scientists, engineers, and analysts--aided by the contributions of many additional talented staff from government, industry, and academia--has been given direct access to data on various stealth programs and sufficient funding to conduct major experiments. These researchers have operated independently of stealth program managers and industrial contractors. Their findings have been reported directly to the Air Force leadership.

Substantive experiments in areas where knowledge was uncertain or the interactions very complex were (and remain) key features of these investigations. Such experiments guard against drawing the wrong conclusions from oversimplified or inaccurate views of the interaction between air defenses and stealthy air vehicles. This experimental approach guides and provides confidence in Air Force survivability assessments.

IV. AIR DEFENSE VS. STEALTH--GENERAL OBSERVATIONS

All air defense systems employ three inter-related functions:

1) *Surveillance* is the mechanism that searches broad volumes of air space to locate the target.
2) *Fire Control* involves tracking the target to establish its current position and potential future position, identifying the target as hostile or threatening, and guiding some form of weapon to the target's immediate vicinity.
3) *Kill* involves bringing a weapon close enough to the target to allow the weapon's fuze to detect the target and then fire the warhead within lethal range.

These three fundamental functions are tightly interwoven and controlled by some form of a command, control, and communication network. Capable air defense systems must be able to accomplish these three main functions reliably against all potential threats. For example, if these three functions were each carried out with a 50% probability of success, the overall kill rate of the air defense system is only 12.5%. If an overall kill probability of about 50% is desired, each task must typically be carried out with an 80% probability of success. If any one function is done poorly, the net overall effectiveness is very low. For example, 80%, 20%, and 80% success rates in each function yield only a 13% probability of overall success.

Compounding matters, air defense systems must also be able to:

1) Survive direct attacks
2) Successfully resist a wide variety of countermeasures and tactics such as electronic jamming and low altitude flight.
3) Function in a full range of the highly variable natural environment: wind, rain, snow, clouds, fog, sunlight, night, clutter from ground, sea, birds, insects, weather, meteors, aurora, and electrical noise (galactic, lightning induced, seismic, cosmic ray).

The third requirement is often the limiting factor, particularly in the case of proposed unconventional air defense schemes. The approach of "hiding in the natural background clutter" is not new. Animals and plants have used it for millions of years to survive--many living species have developed protective colorations and changeable colorations to hide in the clutter from their enemies. In a similar vein, military forces have employed a wide range of camouflage schemes to enhance survivability both on the ground and in the air. Naturally occurring effects often have dramatic impact on the operability of systems that initially appear to offer a potential to counter stealth vehicles. For example, infrared radiation from a target will not pass through clouds and will also be attenuated by water vapor and other constituents in clear air. This tends to dramatically reduce the potential role played by infrared sensors in air defense systems. Infrared systems can be important adjuncts to the all-weather, long-range capabilities of radar, but still cannot be considered a viable substitute.

Developing a confident physical model of this background interference phenomena is very challenging--even more challenging is devising methods to electronically mitigate the effect of the interference on surveillance, tracking, and kill systems. For example, a typical look-down radar on a modern fighter aircraft needs to reduce the magnitude of the radar return from the earth (radar clutter) by a factor of about *one hundred million* before it can detect a small, low-flying air vehicle like a cruise missile.

Stealthy aircraft dramatically reduce the effectiveness of all three basic air defense functions--surveillance, fire control, and kill--to enjoy greatly enhanced survivability. Stealth reduces the size of signals available to the defense sensors which in turn:

- Reduces the probability that surveillance, fire control, and kill will successfully occur, and if they occur, reduces the range at which they happen. A reduction of an aircraft's radar signature by a factor of 10 reduces radar detection range to one third its original value; a factor of 100 signature reduction reduces radar coverage area to one-tenth its original value.
- Weakens the defense system's ability to cope with interference from ground clutter, man-made noise, and false targets such as birds.
- Weakens the defense system's capability to cope with an adversary's tactics, such as flying at low altitudes or employing electronic countermeasures. This is an important additional attribute of stealth. Electronic jamming, for example, becomes considerably easier and more effective when combined with stealth airframes. As the aircraft signature is reduced, the required jammer power and size is also reduced in proportion.

Overall, these effects on air defense systems provide stealth aircraft with a very high degree of survivability. Stealth aircraft are neither invisible or immortal, but pose so many challenges to air defense systems that their survivability is much greater than conventional aircraft.

V. CONVENTIONAL AIR DEFENSES

Most conventional air defenses use radar as the principal sensor. Radars can search large areas, day or night, in all weather conditions to provide accurate location of targets and guide interceptor aircraft or missiles to the target. To deal with stealthy air vehicles such as the B-2 would require substantial improvements in a typical air defense radar. Radar sensitivity must be enhanced to detect the much weaker radar returns from the stealthy target. Clutter rejection capabilities must be dramatically improved to prevent the weak target return from being lost amidst a multitude of other radar returns from the ground, birds, weather, etc. And the radar's resistance to electronic countermeasures must also be improved for the same reason.

If the required improvements in sensitivity, clutter rejection, and countermeasures resistance only involved a tripling or quadrupling of capabilities, this would be a difficult, but not overwhelming task. But the required improvements will typically be much greater.

Designers of the typical ground radars used for surveillance and/or fire control could, if provided with sufficient funds, approach this problem by building a much bigger antenna and transmitter. Fixed sites with such improvements would, of course, become lucrative defense suppression targets; improved mobile units could become more restricted in terms of movement and thus more vulnerable. Although ground-based radars can accommodate the much bigger hardware, aircraft and satellites typically cannot because of size limitations. Air defense kill mechanisms--typically a guided missile--encounter similar problems. These missiles usually house a nose-mounted antenna as part of the guidance system. Such antennas are strictly limited in size by the diameter of these slender missiles. The designer has little freedom to increase the antenna size and consequently the missile seekers are often the greatest challenge to overcome in defending against stealth aircraft.

The physical constraints influencing air- or space-borne radars greatly enhance the survivability of the B-2. The greatest threat to penetrating bombers today are airborne defenses that combine airborne early warning platforms (such as the USAF's E-3A or the Soviet Mainstay) and look-down, shoot-down fighters. Such defenses can detect low-flying conventional aircraft out to ranges of up to 250 miles. The location of these defenses at any moment in time is unpredictable, making evasive routing difficult. But stealth technology essentially takes these airborne air defense threats out of the picture.

Ground-based systems can be larger. Radar ground stations do not suffer the same physical limitations as air or space platforms and large surface-to-air missiles, for example, have the edge over air-launched missiles, which are typically smaller. But the B-2 poses an array of additional challenges to ground defenses. Many radar systems cannot accommodate the very substantial upgrades to detect the B-2 and their coverage zones are too small to support successful defense against this bomber. Some big powerful radars, though, do have a useful detection capability. In response, the B-2 could employ evasive routing, fly low to reduce coverage, and/or employ stand-off weapons to attack targets in the vicinity of these radars. Some of the larger capable radars could be mobile. But the B-2's crew could detect the radiation from these radars long before the radar detects the bomber (a simple matter of physics) and then avoid the threat.

Some critics argue that stealth is not as effective against Very High Frequency (VHF) radars as against higher frequency radars. When the B-2 was designed, the Soviets already had deployed about 2000 VHF surveillance radars, which were clearly a well recognized part of the air defense threat that challenged the B-2's designers. The B-2's design can deal with this class of radar. In any case, VHF is not a particularly effective surveillance tool for air defense systems. Although generally low in cost, VHF radars have serious problems in detecting low flyers and coping with man-made interference and jamming.

To measure the B-2's capabilities against these varied air defense systems, the Air Force and its independent investigations have employed calculations and computer models, all backed up by actual field experiments. Special radars, infra-red systems, and other sensor systems were built where adequate equipment did not exist. The resulting experimental data allows engineers to characterize the performance of a wide range of sensors with substantial confidence. The B-2 will fly against these and many other sensors to confirm its survivability. Before the availability of a B-2 airframe for testing, hundreds of flight tests were run with F-117 stealthy fighter aircraft and other classified air vehicles against the AWACS and F-15 airborne systems, the improved HAWK ground-based SAM, and numerous other sensor and weapons systems. As a result of these years of experimental work, survivability prediction capability is quite good.

In summary, overall survivability is not seriously threatened by occasional detections or sporadic tracking. Successful air defenses need to consistently detect, track, and kill targets. It is a tall order to accomplish all three of these functions with conventional air defenses in the face of the B-2's stealth technologies. That leaves the matter of unconventional air defenses.

VI. UNCONVENTIONAL AIR DEFENSES

Many fertile and inventive minds in the U.S. and elsewhere have taken up the challenge of projecting or imagining numerous unconventional air defense schemes. All of these assert to show that the B-2 aircraft can be detected--that it is not invisible.

The B-2 is obviously not invisible. But what is needed for successful air defense against the B-2 is detection, tracking, and kill capabilities at relatively long operating ranges (e.g., 25 to 200 miles depending on the style of defense). At such ranges, the various signals available from the B-2 are generally very weak, and easily lost in the noisy background or obscured by ground clutter, weather, clouds, and other phenomena.

Some 50 or so unconventional air defense concepts have been proposed. All of these have been analyzed, some in substantial detail, and some have even been tested experimentally. The details of these investigations are classified, but we can list below some of the concepts that have been investigated over the years:

Acoustic Systems
Bi-static Radar Systems
Infrared Detection Schemes
Corona Discharge Detection
Interaction with Cosmic Rays
Passive Coherent Detection Schemes
Radar Shadow Detection
Land Mines
Magnetic Disturbance Detection
Hybrid Bi-static Space Radar
High Frequency Surface Wave Radar
Detection of Aircraft Emissions
Radiometric Detection
Air Vehicle Aerodynamic Wake Detection
Ultra Wideband (Impulse) Radar

Examining one of these approaches--acoustic systems--provides an instructive illustration of the difficulties of turning an intuitively attractive idea into a viable unconventional air defense system. An acoustic detection scheme offers many attractions: large aircraft emit lots of acoustic energy (noise) and the basic detectors of this energy (microphones) are simple and cheap. Each detection sensor might be a simple array of perhaps five microphones with the capability to detect a B-2's acoustic signal out to a range of about five miles and make a crude estimate of the direction of arrival of the signal. Signals from such a sensor could then send detection and direction information to a central facility for processing.

Employing such sensors, a Soviet air defense system designer would need to build a "fence" of sensors to cover all possible B-2 routes into the Soviet Union. Such a fence would be roughly 14,000 miles long[2] thus requiring about 1400 sensors. Such a "fence" could warn of passage of any aircraft through its coverage. So far, this is a simple system as air defenses go.

This system, however, has many shortcomings. A momentary or short detection sequence is not enough to stop a stealthy aircraft: the system needs to track and kill for successful defense. Designers would need to expand the width of the "fence" to track the B-2 and guide interceptors for the kill. To track the B-2 with acoustic sensors would require a "deep" fence capable of keeping the B-2 in track for a sufficient period for an interceptor to close and kill--say fifteen minutes. In fifteen minutes, a B-2 flying at, say Mach 0.8, would traverse about 150 miles, thus requiring the sensor fence to be of a similar depth. Such a fence would cover 2.1 million square miles. Each acoustic sensor with a 5-mile range could cover about 78 square miles, so 27,000 stations would be required. As can be seen, the need to detect, track, and kill turns this simple concept into a far more complex and costly system than first envisioned.

Tactics, countermeasures, and other architectural problems would also reduce this acoustic system's effectiveness:

- If a B-2 crossed the fence at high altitude, the acoustic signals would be very weak
- Soviet aircraft would ring the fence alarm as well as U.S. aircraft
- A few U.S. cruise missiles intentionally flying along the fence would ring many of the alarms.
- The United States could destroy one or a few small segments of the fence or move a penetrating bomber force through only a few places to saturate the air defense interceptors which must necessarily cover the entire fence.

Fielding such a system also poses many formidable technical challenges:

- Acoustic sensors are severely degraded by wind noise.
- Atmospheric propagation effects can cause "quiet" zones where microphones cannot hear very well (much as layers of differing temperatures in the ocean provide hiding places for submarines).

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[2] A similar fence around just the Continental United States would be about 7000 miles long; a fence around all of North American about 10,000 miles long.

- Snow, ice, and rain could degrade the operability and reliability of the microphones (a particular problem for the Soviets since the most important part of this fence would be close to the Arctic Circle).
- The interceptors would still have a very difficult job of detecting, tracking, and killing the B-2 as explained earlier in the section on conventional defenses.

The shortcomings of this hypothetical air defense system do not necessarily mean that acoustic sensors are useless for air defense. But the problems do illustrate the potential complexities of such a system and raise questions about its overall viability.

The analysis illustrated above has been highly simplified. The real Air Force investigation involved a comprehensive experimental examination of aircraft acoustic signatures, acoustic propagation, and background interference phenomena. Actual field tests were run employing state-of-the-art acoustic detectors, electronics, and advanced signal processing schemes. Engineers and analysts developed a realistic view of available detection ranges for differing aircraft flying various speeds at high and low altitudes.

In a similar fashion, the assessment teams subjected all the other unconventional air defense techniques to intense investigation. Many could be shown to lack any serious merit very quickly; some, like the acoustic approach, required substantial field testing. To date, these investigations have not found an unconventional air defense approach that would provide a robust air defense capability against the B-2. This is not to say that more effective approaches may not be developed in the future. The Air Force believes that a continuing and vigorous search for unconventional defense ideas (including ideas from the full U.S. scientific community) is needed and the more promising concepts subjected to field experiments to confidently assess their viability.

VII. THE ROLE OF THE U.S. COUNTER-STEALTH PROGRAM

The final measure needed to maintain a credible assessment of stealth air vehicle survivability is a vigorous U.S. program in counter-stealth technology. We cannot expect that the Soviet Union, or other nations, will allow the United States to be the sole practitioner of these technologies. The competition for foreign military sales alone could force major arms-producing nations to aggressively pursue stealth technology. U.S. forces must be prepared to deal with attacks by stealthy anti-ship missiles, cruise missiles, and aircraft. In the future, such sophisticated weapons might even be in the hands of third world nations. These factors provide strong incentives to aggressively pursue vigorous research into the counter-stealth area.

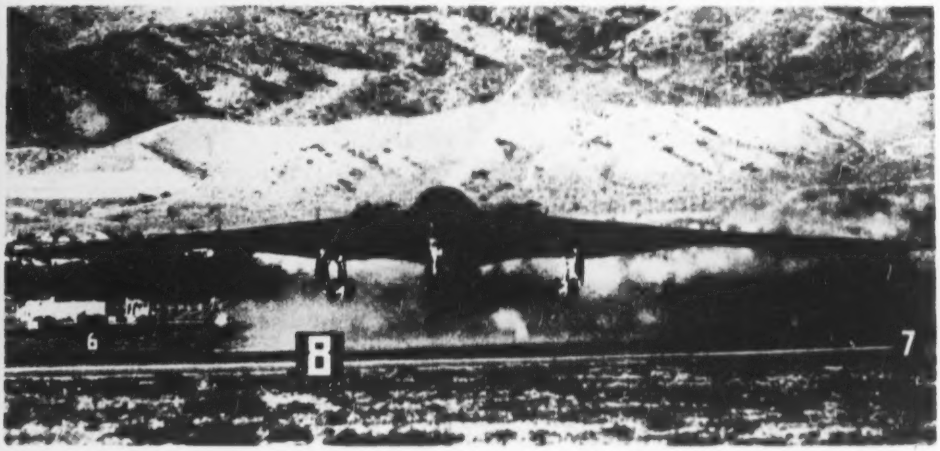
We are currently well situated for such research. The United States has developed an extensive data base of design and performance information on a variety of stealthy air vehicles. Our stealth survivability investigations have sorted through numerous defense schemes to identify the most promising and avoid wasting talent and money on unworkable ideas.

Counter-stealth research also serves well as the audit on B-2 survivability assessments. If the counter-stealth effort quickly recognized and developed a simple but robust defense response to stealth, then the whole B-2 survivability assessment process would be suspect. If, on the other hand, the counter-stealth team has to work hard to develop solutions and employ high-risk, expensive technology and futuristic electronics in their selected approaches, B-2 survivability assessments are valid and reliable. The latter case is the situation today--the counter-stealth program is finding no effective, affordable way to defeat stealth.

VIII. CONCLUSIONS

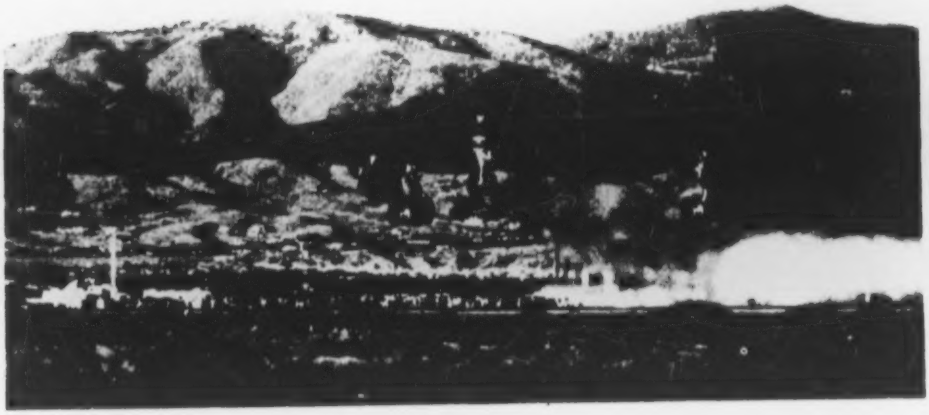
Survivability has been the cornerstone of the B-2 program since its inception. A continuous activity aimed at understanding and auditing the survivability of stealthy air vehicles against a wide variety of possible current and future air defenses, both conventional and unconventional, has been underway for many years. At this time, the net assessment is that the B-2 is, and will remain, highly survivable. In the more distant future the situation may change, but the United States already has in place the right kind of national activities--namely, strong industrial teams in stealth technology, a vigorous Air Force survivability assessment activity, and a counter-stealth program--to stay ahead of our adversaries in this critical area. Finally, in anticipation of the "action-reaction" cycle, the designed-in growth capabilities of the B-2 will allow it to remain resilient to future technological advances in air defenses.

BOMBER MODERNIZATION: DETERRENCE AT THE CROSSROADS



JUNE 1990

BOMBER MODERNIZATION: DETERRENCE AT THE CROSSROADS



OVERVIEW

- The Strategic Bomber Modernization effort is approaching a key crossroad, with decisions pending on the B-2 program that will influence the composition and effectiveness of the bomber leg of the Strategic Triad.
- This briefing presents the Air Force's view of the bomber modernization roadmap by discussing the contribution of the B-2 to ensuring effective deterrence into the 21st century.

OUTLINE

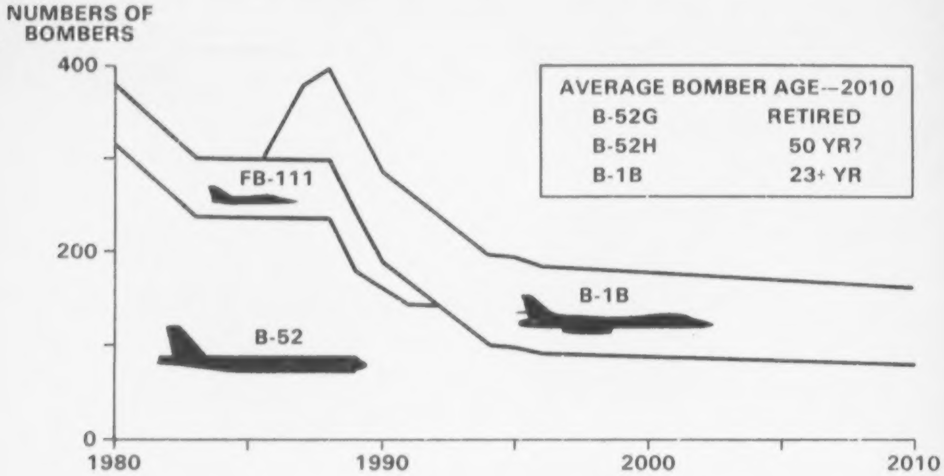
- BOMBER OUTLOOK
- CONTRIBUTION TO DETERRENCE
- STEALTH
- CONVENTIONAL CAPABILITIES
- COST/AFFORDABILITY
- CONCLUSIONS

OUTLINE

- This briefing reviews the outlook for the strategic bomber force as we approach the turn of the century, highlighting the contributions stealth technology will make in support of our national policy of strategic deterrence.

- In addition to discussing the strategic nuclear applications of the B-2, the briefing also addresses the conventional capabilities of this revolutionary platform before concluding with a discussion on the affordability of this top-priority national program.

BOMBER AGING OUTLOOK



WITHOUT THE B-2:

- WE HAVE NO EFFECTIVE PENETRATING BOMBERS BY THE END OF THE DECADE
- IN THE FOLLOWING DECADE, THE NUMBER OF BOMBERS CONTINUES TO DECLINE, THE NEWEST BEING OVER 23 YEARS OLD

BOMBER AGING OUTLOOK

- o The key decision confronting us is whether we should continue on the course set in the early 1980s to modernize the strategic bomber leg or whether we should abandon our investment in light of the changing geopolitical events in Europe.

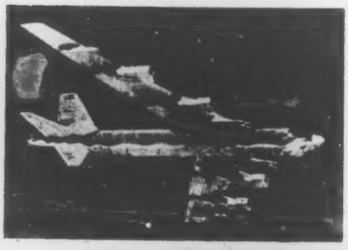
- o In 1981, a two-bomber modernization program was endorsed by Congress. We have successfully executed the first phase of this effort with the deployment of 100 B-1Bs.

- o Even with the B-1B force in the field, this chart reveals the progressive downward trend in overall bomber force structure as we close out this century.

- o Without the acquisition of the B-2, the number of bombers available for deterrence or conventional applications will continue to atrophy to an unacceptable level. In addition, the penetration capability of the B-52 and B-1B will most assuredly be called into question, necessitating an adaptation of roles and missions for those bomber resources.

COMPARISON OF ALL-STANDOFF TO MIXED FORCES

ADVANTAGES OF ALL-STANDOFF
LOW ACQUISITION COSTS
LOW LIFE-CYCLE COSTS



ADVANTAGES OF MIXED
SPREADS OUT SOVIET DEFENSES
DAMAGE ASSESSMENT/STRIKE
HIGH-YIELD WEAPONS
LOWER COST WEAPONS
MORE REDUNDANCY IN DETERRENT FORCE
MOST TOTAL WEAPONS UNDER START
FLEXIBLE CONVENTIONAL CAPABILITY
BEST POTENTIAL TO HOLD RELOCATABLE TARGETS AT RISK

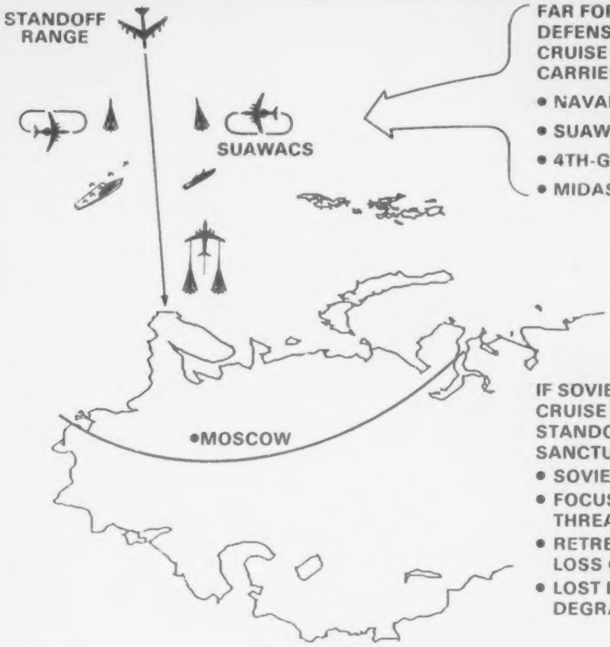
COMPARISON OF ALL-STANDOFF AND MIXED FORCES

o Some have suggested a total reliance on standoff cruise missile carriers as a competitive strategy to the acquisition of a modernized bomber force with the B-2 -- -- The Air Force disagrees with this approach.

o Without a credible penetrating bomber force, our employment options are limited to total reliance on a standoff cruise missile force. Although the all-standoff force has some cost advantages, the military utility of such a force is highly questionable, since its warfighting benefits are limited.

o Air Force judgment and conventional military wisdom support the determination that a mixed force of penetrating bombers and cruise missiles places the maximum stress on the Soviet air defense system.

ALL-STANDOFF VERSUS FAR FORWARD DEFENSE



FAR FORWARD DEFENSE AGAINST CRUISE MISSILE CARRIERS

- NAVAL AIR DEFENSES
- SUAWACS
- 4TH-GENERATION INTERCEPTOR
- MIDAS TANKER

IF SOVIETS CAN CONCENTRATE ON CRUISE MISSILE CARRIERS, THEN STANDOFF DOES NOT MEAN SANCTUARY

- SOVIET DEFENSIVE TASK SIMPLIFIED
- FOCUSED FAR FORWARD DEFENSE THREATENS STANDOFF FORCE
- RETREAT FROM THREAT RESULTS IN LOSS OF TARGET COVERAGE
- LOST FLEXIBILITY FURTHER DEGRADES TARGET COVERAGE

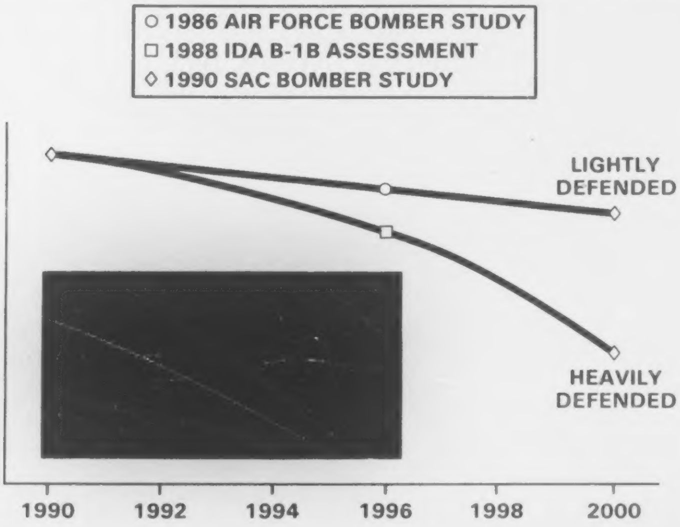
FAR-FORWARD DEFENSE

o The most obvious disadvantage of an all-standoff cruise missile force is that it would be susceptible to a focused far-forward defense. The destruction of the cruise missile carrier aircraft before it reaches the cruise missile launch point would be a logical objective of the Soviet air defense system.

o A pure standoff force would certainly simplify the Soviets' defensive task, forcing us to continually retreat in the face of the Soviet defensive threat at the expense of target coverage.

o We challenge the myth that standoff equates to sanctuary -- We are better served by a mixed force composed of cruise missiles and penetrating bombers that would force the Soviets to build a prohibitively costly defense in depth.

ESTIMATED B-1B PTP



B-1 CANNOT EFFECTIVELY PENETRATE MUCH BEYOND 2000

B-1B PTP

- A secondary question influencing the B-2 debate is whether the B-1B can continue its role as an effective penetrator.

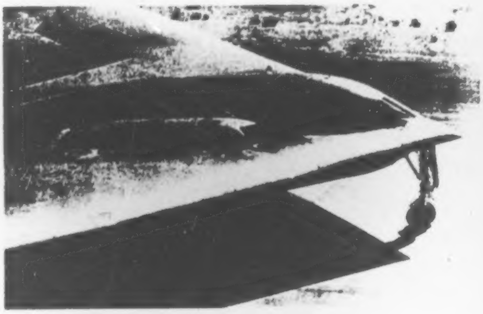
- The question of B-1B penetrativity has been extensively investigated by the Air Force, OSD, and several independent organizations at the direction of Congress.

- The Air Force view is clear -- B-1B penetrativity will continue to erode in the next decade, necessitating a selective tailoring of its missions against lightly defended targets; however, the B-1B's penetration potential is enhanced when a mixed force of B-1Bs and B-2s is employed.

- A team of B-2s and B-1Bs provides a knockout punch, with the B-2 targeted against the heavily defended targets while the B-1B's missions are tailored to the less demanding penetration routes.

EFFECTIVE DETERRENCE REQUIRES

- ASSURED, DEVASTATING RETALIATION CAPABILITY
  - —SURVIVING THE ATTACKER'S OFFENSIVE STRIKES
  - —PENETRATING ENEMY DEFENSES TO RETALIATE
- STABILITY IN CRISIS



STEALTHY BOMBERS PROVIDE BOTH

EFFECTIVE DETERRENCE

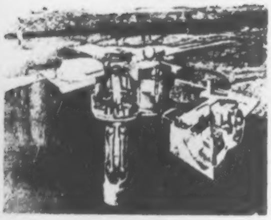
- o We must not lose sight of our objective as we make these crucial national resource allocation decisions.
- o The objective of bomber modernization is twofold -- a credible warfighting capability providing stability in crisis.
- o Certainly, the B-2 provides both these essential attributes while capitalizing on revolutionary stealth technologies.

THE BALANCED TRIAD

BOMBERS

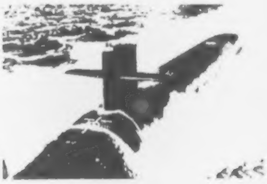
- PROVEN IN COMBAT
- MAN-IN-THE-LOOP
- SURVIVABLE
- RECALLABLE
- REUSEABLE
- RAPID GLOBAL MULTIMISSION
  - —CONVENTIONAL ATTACK
  - —SEA SURVEILLANCE
  - —MARITIME INTERDICTION
- RELIEVES DECISION TIME PRESSURE
- DEMONSTRATES RESOLVE IN CRISIS BEFORE DETERRENCE FAILS

ICBMs



- LOW O&S COST
- HIGH DAY-TO-DAY ALERT
- IMMEDIATE RESPONSE
- NO RECALL
- NO RECYCLE
- NO CONVENTIONAL USE
- USE WHEN DETERRENCE FAILS

SLBMs



- SURVIVABLE
- LOW COST/WARHEAD
- PROMPT RESPONSE
- NO RECALL
- NO RECYCLE
- NO CONVENTIONAL USE
- USE WHEN DETERRENCE FAILS

THE BALANCED TRIAD

- The Triad has served us well for over three decades, with each leg bringing unique capabilities to deterrence

- The synergism of the Triad has been the cornerstone of its effectiveness, and its preservation has been the keynote theme of each administration.

- The old adage applies: "If it ain't broke, don't fix it."

- The Triad concept is sound and should not be abandoned. We cannot, however, escape the need for continued investment to maintain the viability of our deterrent strategy.

THE BALANCED TRIAD

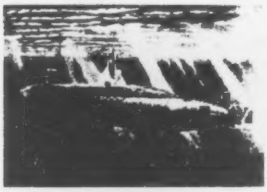
ICBMs

- LOW O&S COST
- HIGH DAY-TO-DAY ALERT
- IMMEDIATE RESPONSE
- NO RECALL
- NO RECYCLE
- NO CONVENTIONAL USE
- USE WHEN DETERRENCE FAILS

~~**BOMBERS**~~

- ~~PROVEN IN COMBAT~~
- ~~MAN-IN-THE-LOOP~~
- ~~SURVIVABLE~~
- ~~RECALLABLE~~
- ~~REUSEABLE~~
- ~~RAPID GLOBAL MULTIMISSION~~
  - ~~—CONVENTIONAL ATTACK~~
  - ~~—SEA SURVEILLANCE~~
  - ~~—MARITIME INTERDICTION~~
- ~~RELIEVES DECISION TIME PRESSURE~~
- ~~DEMONSTRATES RESOLVE IN CRISIS BEFORE DETERRENCE FAILS~~

SLBMs



- SURVIVABLE
- LOW COST/WARHEAD
- PROMPT RESPONSE
- NO RECALL
- NO RECYCLE
- NO CONVENTIONAL USE
- USE WHEN DETERRENCE FAILS

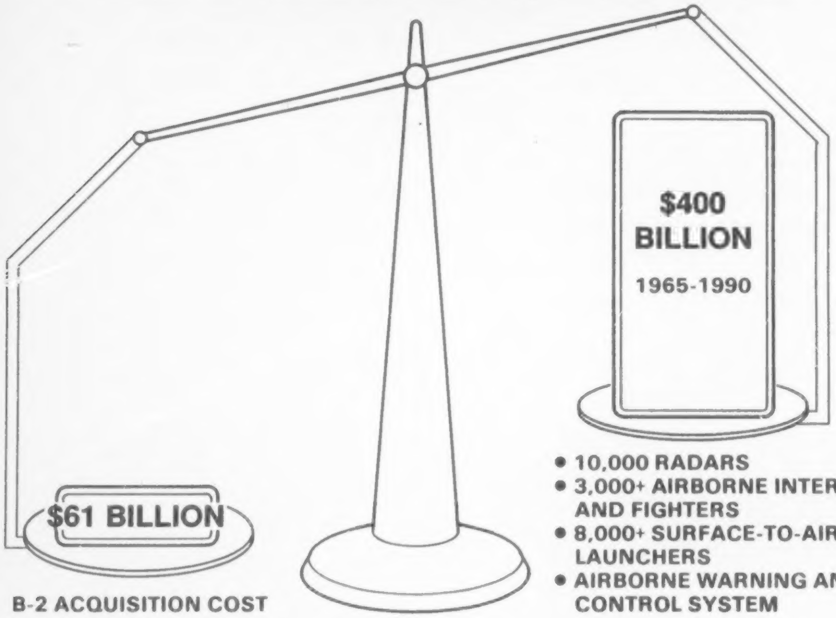
EACH PRESIDENT HAS REQUESTED MORE OPTIONS

TRIAD WITHOUT B-2

- o Without the addition of the B-2, a key stabilizing element of the Triad will be crippled by default, with the resultant loss of presidential options in crisis.

- o The consequences of that unfavorable decision will curtail the President's use of the most stabilizing force in the Triad -- the only leg of the TRIAD that can be called into use before deterrence fails and before we are committed to an exchange of weapons.

B-2 DEFEATS A MASSIVE SOVIET INVESTMENT IN AIR DEFENSES



- 10,000 RADARS
- 3,000+ AIRBORNE INTERCEPTORS AND FIGHTERS
- 8,000+ SURFACE-TO-AIR MISSILE LAUNCHERS
- AIRBORNE WARNING AND CONTROL SYSTEM

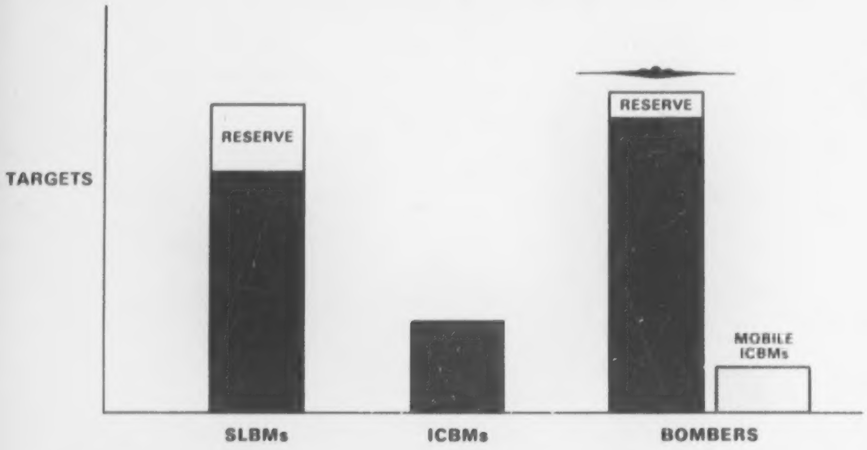
B-2 DEFEATS A MASSIVE INVESTMENT

- The Soviet expenditures in air defense are a huge investment of their national treasure. Current estimates approach the half trillion dollar point.

- The deployment of the B-2 negates this investment, making obsolete a large number of the Soviets' current air defense systems. For the Soviets to attempt fielding a credible defense against stealth will require extraordinary invention and even larger commitments of their already scarce national resources.

THE DETERRENT FORCE

NOTIONAL START FORCES



- THE SOVIET PLANNER SEES THE TOTAL CAPABILITY OF THE TRIAD WITH THE BOMBER FORCE AS A MOST FORMIDABLE DETERRENT
- THE TRIAD HEDGES AGAINST FULL OR PARTIAL FAILURE OF ANY LEG OF THE TRIAD

START -- DETERRENCE

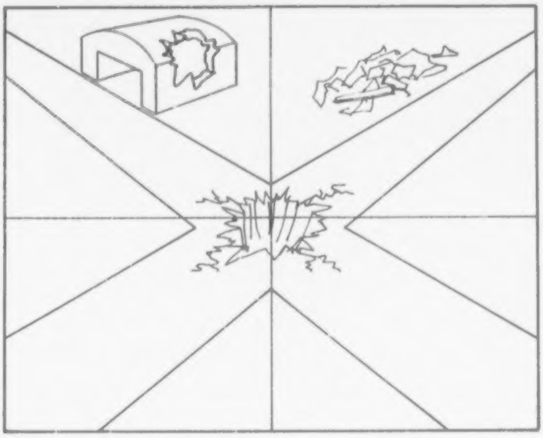
- o Each leg of the Triad is charged with holding Soviet targets at risk.

- o From the Soviet viewpoint, the bomber leg is a formidable force, not to be viewed lightly. In addition to carrying the most accurate and powerful weapons, the bomber is capable of holding all classes of targets at risk.

- o Because of the START counting rules, the bomber leg carries the majority of the strategic nuclear weapons required to support the Single Integrated Operational Plan (SIOP).

MAN-IN-LOOP = FORCE MULTIPLIER

- IN A TARGET-RICH/WEAPONS-POOR ENVIRONMENT, DAMAGE ASSESSMENT/STRIKE MISSIONS ARE A VITAL FORCE MULTIPLIER

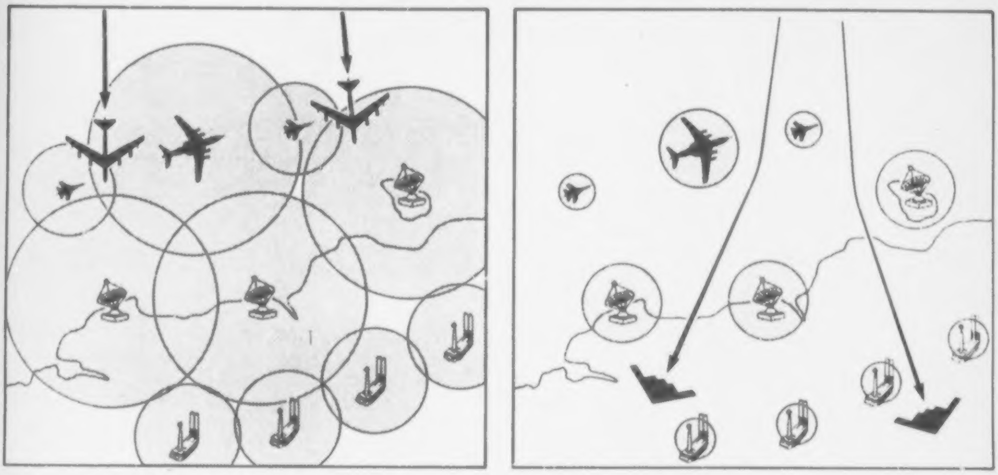


MAN-IN-THE-LOOP

- Reductions in both delivery platforms and actual weapons, beyond START, may lead to an environment that can be characterized as target rich and weapons poor. In other words, there will be more targets than weapons available to strike them.

- Consequently, the unique ability of the bomber to inspect a target and assess damage levels prior to delivery of a weapon creates a force-multiplying effect. A single bomber can now cover additional targets through this selective employment/inspection process.

PENETRATING AIR DEFENSES



CONVENTIONAL BOMBER

B-2

B-2 STEALTH TECHNOLOGY SHRINKS
DEFENSE ENGAGEMENT EFFECTIVENESS

PENETRATING AIR DEFENSES

- Conventional air defense systems present an attacking aircraft with a formidable array of layered radar systems capable of detecting and attacking a penetrating aircraft.

- Stealth not only reduces the effectiveness of one class or category of air defense weapons, but also literally shrinks the coverage possible for the entire air defense system.

- Because no one air defense system has the advantage, penetration avenues for the attacking bomber are created which greatly increase the stealth aircraft's penetration capabilities and mission planning options.

TYPICAL RADAR CROSS SECTIONS

SHIPS

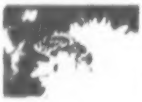
	M^2	dBSM
CARRIER	300,000	+55
CRUISER	200,000	+53
DESTROYER	50,000	+47
FRIGATE	6,000	+38
POWER BOAT	500	+27

BIRDS

	M^2	dBSM
MALLARD	0.01	-20
PIGEON	0.003	-25
STARLING	0.001	-30

AIRCRAFT

	M^2	dBSM
JUMBO JET	100	+20
DC-9	20	+13
MEDIUM FIGHTER	10	+10
SMALL FIGHTER	4	+6
SMALL AIRCRAFT	1	0
CONVENTIONAL UNMANNED WINGED MISSILE	0.5	-3



INSECTS

	M^2	dBSM
BLUE-WINGED LOCUST	0.001	-30
HONEYBEE (WORKER)	0.0001	-40
ALFALFA CATERPILLAR BUTTERFLY	0.000063	-42

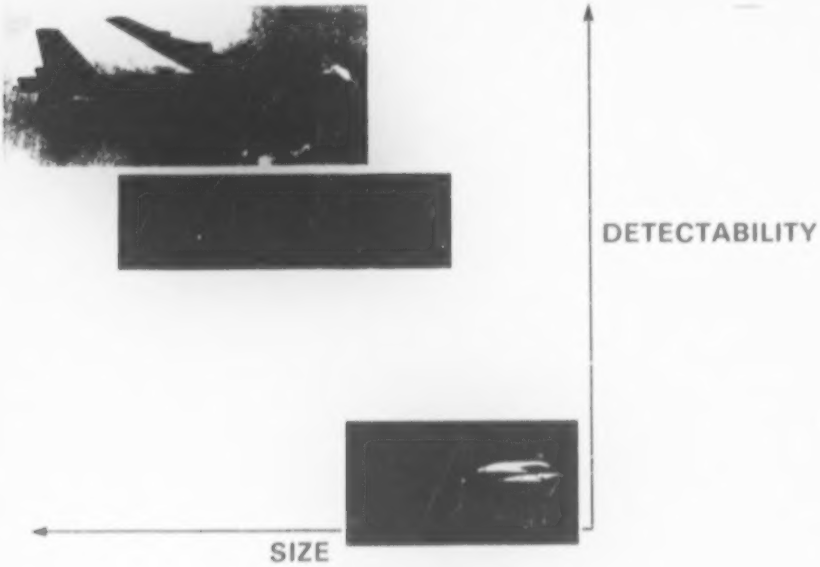
RADAR CROSS SECTION

- Modern air defense systems are highly reliant upon radar for aircraft detection and engagement. Consequently, reduction of an aircraft's radar cross section (RCS) directly impacts the effectiveness of the air defense network by enhancing the penetration capabilities of the airborne platform.

- The B-1B represents the first generation in stealth technology, whereby a large bomber appears smaller than a modern fighter on a radar screen.

- Current stealth technology is driving the radar aspects even lower. The B-2 is on the cutting edge of this technology.

RELATIVE SIZE AND RADAR CROSS SECTION

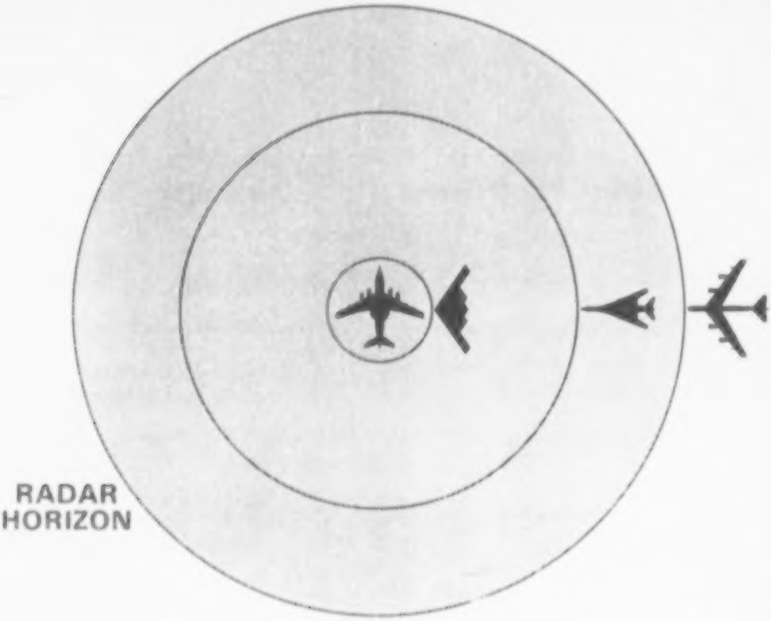


RELATIVE SIZE AND RCS

- Reducing a bomber's radar cross section (RCS) directly impacts the performance of the air defense radar.

- This reduced radar effectiveness translates to an electrical or radar size.
  - The B-52 and B-2 are comparable in physical size; however, the B-2's significantly reduced radar cross section minimizes the detectability of the B-2 to the point it can operate with virtual impunity.

SOVIET AWACS DETECTION RANGES—LOOK-DOWN/NOSE ON

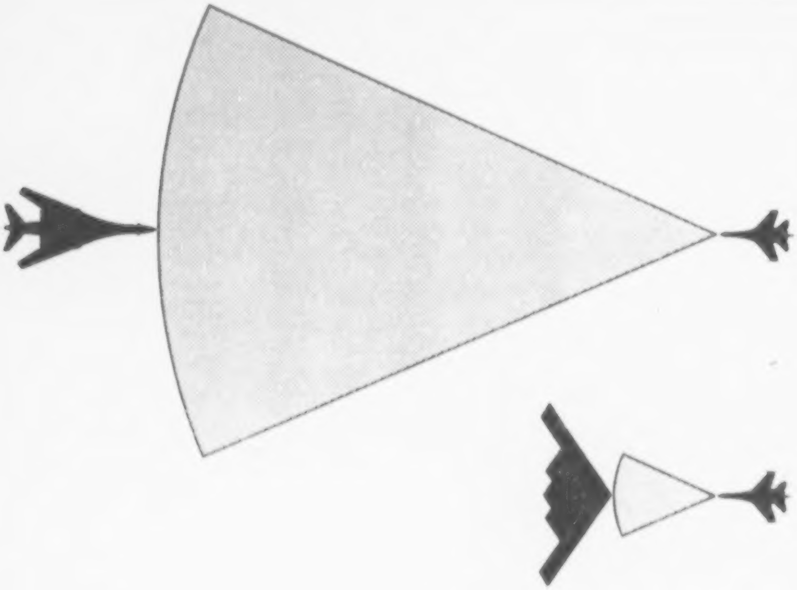


SOVIET AWACS

- Compared with older aircraft like the B-52 or a first-generation stealth aircraft like the B-1B, the B-2 offers greater survivability by significantly reducing existing air defense radar effectiveness.

- The RCS of the B-2 reduces the effectiveness of the Soviet AWACS to the point where the Soviets do not possess enough AWACS assets to make up for the reduction in coverage. This results in more mission planning options for the B-2.

LOOK-DOWN/SHOOT-DOWN FIGHTER VERSUS BOMBER



LD/SD FIGHTER

o Reducing the RCS of the B-2 also affects the capability of an attacking Soviet look-down/shoot-down fighter.

o Given an expanse of air space to search for the B-2, a reduced look-down/shoot-down radar range will significantly increase the fighter's search time.

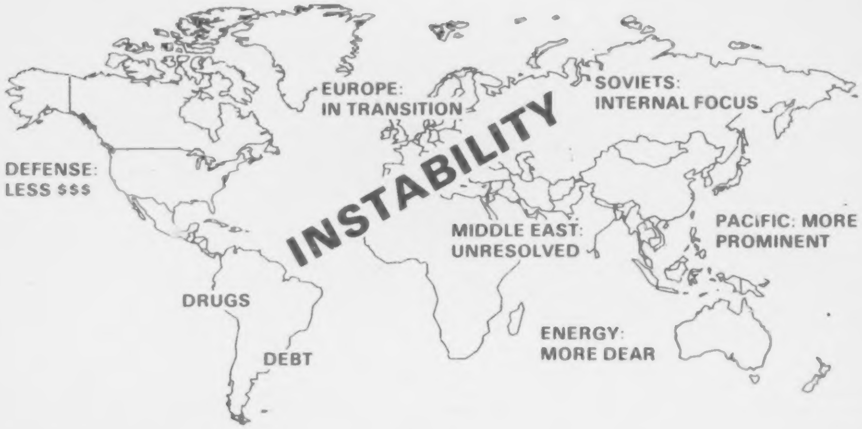
o The probability of the B-2's experiencing a chance encounter with a fighter is greater than that of being found by the fighter's radar.

THE CONTINGENCY MISSION

DIVERSE THREATS IN A CHANGING WORLD

- NON-SOVIET THREATS MORE LETHAL

- CFE AND START: DONE
- FUTURE NEGOTIATIONS: ?


EUROPE: IN TRANSITION
SOVIETS: INTERNAL FOCUS
DEFENSE: LESS $$$
INSTABILITY
MIDDLE EAST: UNRESOLVED
PACIFIC: MORE PROMINENT
DRUGS
DEBT
ENERGY: MORE DEAR

- OPERATING ENVIRONMENT
  - REDUCED FORWARD BASING
  - PROLIFERATION OF HI-TECH WEAPONRY
  - ECONOMIC CHANGE

THE CONTINGENCY MISSION

- **The flexible manned bomber is the only system in the Triad that can be used in conventional operations, as has been demonstrated many times in the post-World War II era.**

- **The long-range B-2 bomber can make significant contributions across the entire spectrum of conflict with its robust and unique conventional capabilities.**

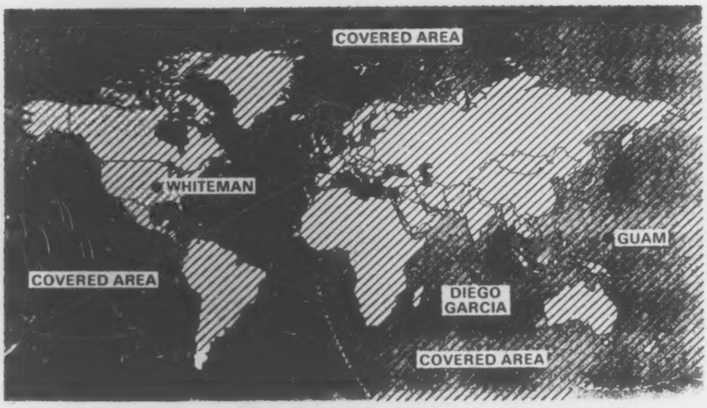
- **In many ways, the B-2 embodies the inherent characteristics of air power itself: speed, range, lethality, and flexibility -- all complemented by the key dimension of survivability.**

- **In an uncertain world where instability is the prevailing undercurrent, the B-2 can lay the foundation for addressing diverse threats that could emerge.**

B-2 CONVENTIONAL CAPABILITY

WORLDWIDE FORCE PROJECTION CAPABILITY

- 48,000-LB PAYLOAD + ONE REFUELING COVERS THE GLOBAL LANDMASS


COVERED AREA
WHITEMAN
GUAM
COVERED AREA
DIEGO GARCIA
COVERED AREA

B-2 CAN HOLD VIRTUALLY EVERY TARGET IN THE WORLD AT RISK WITHIN 24 HOURS

B-2 CONVENTIONAL CAPABILITIES

- The B-2 packs a powerful punch with its devastating conventional arsenal.
- The B-2's range/payload combination permits it to precisely deliver massive amounts of conventional ordnance to virtually any location on the planet with impunity.
- From only three basing locations, one refueling would be required to provide the worldwide land and sea coverage shown.

OPTION: A TAILORED FORCE PACKAGE

SUPPORT ASSETS REQUIRED TO DELIVER 120 TONS
OF ORDNANCE FOR A LIBYAN-SIZE TASK

NO	WPN SYS	TANKERS	SEAD A/C	AIR DEF A/C	TOTAL A/C	TOTAL SHIPS	PERSONNEL AT RISK
30	FB-111	57	10	4	101	0	302
10	B-52H	32	10	4	56	0	202
2	CVBG	–	–	–	172	20	12,000+ (376 AIRCREW)
6	B-2	6	0	0	12	0	36

TAILORED FORCE PACKAGE

- Sovereign-based B-2s can deliver a powerful message to any adversary while minimizing the number of forces and personnel placed at risk.

- A total of six B-2s, supported by an equal number of tankers, could with ease perform a Libyan-size raid, delivering 120 tons of ordnance.

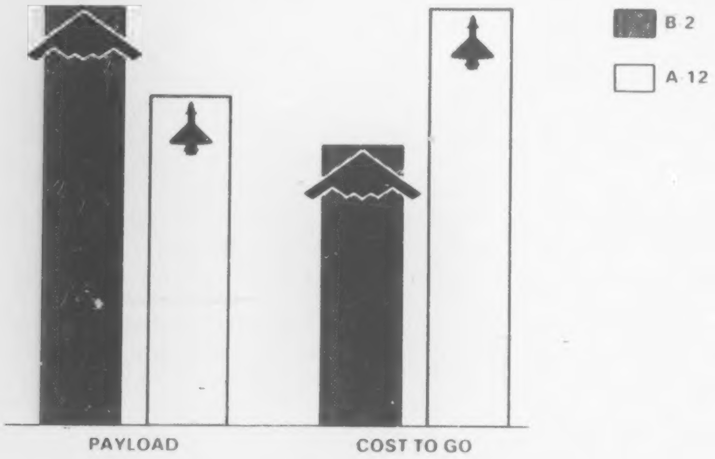
- Some question the use of a high-value asset like the B-2 for such a mission. It should be remembered that the United States has flown the high-value, advanced-technology SR-71 reconnaissance aircraft in harm's way for several decades. We did so because the situation warranted it, and the capabilities built into the aircraft permitted its employment in that manner.

- The B-2 is no exception.

CONVENTIONAL CONTINGENCY AIR OPTIONS

AFFORDABILITY

- THE COST-EFFECTIVENESS OF ATA / A-12 FOR CONVENTIONAL MISSIONS IS WELL ACCEPTED
- BY THAT AND ANY OTHER STANDARD, THE B-2 IS A COST-EFFECTIVE CONVENTIONAL ATTACK SYSTEM
  - A USEABLE FORCE OF B-2s CAN DELIVER 21% MORE PAYLOAD AT INTERCONTINENTAL DISTANCES FOR 31% LESS COST THAN THE A-12 REQUIREMENT



CONVENTIONAL CONTINGENCY AIR OPTIONS

o The B-2's combination of long range, high payload, deadly accuracy, and inherent survivability enables it to compare very favorably with tactical aircraft in many areas.

o For less money, B-2s can deliver more payload over global distances.

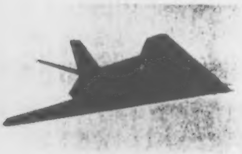
THE RIGHT STANDARD FOR JUDGING THE B-2

- IT IS WIDELY ACCEPTED THAT
  - —WE MUST HAVE STEALTH TECHNOLOGY AIRCRAFT TO PENETRATE ENEMY AIRSPACE FOR DEEP INTERDICTION (ATA/A-12) AND FOR AIR SUPERIORITY (ATF)
  - —STEALTH AIRCRAFT ARE CONSIDERED AFFORDABLE FOR THOSE PURPOSES
- THE NEED FOR A STEALTH TECHNOLOGY AIRCRAFT FOR THE STRATEGIC NUCLEAR ROLE AND FOR COST-EFFECTIVE LONG-RANGE CONVENTIONAL MISSIONS IS EVEN MORE PRESSING
- THE B-2 IS FAR MORE COST-EFFECTIVE FOR A WIDE RANGE OF NUCLEAR DETERRENT AND LONG-RANGE CONVENTIONAL TASKS THAN OTHER WELL-ACCEPTED APPROACHES

THE RIGHT STANDARD

o Stealth technology will revolutionize both the tactical and strategic battlefield.

THE B-2 ADVANTAGE
DETERRENCE FOR THE 21ST CENTURY



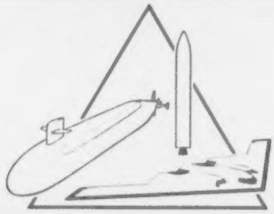
- KNOWLEDGE OF LOW OBSERVABLES (LO) IMPACTS IN INFANCY
- NO TURNING BACK; STEALTH TECHNOLOGY IS HERE—THE BATTLEFIELD IS CHANGED
- LO PLATFORMS WILL CHANGE STRATEGIC LANDSCAPE
  - —EMPLOYMENT CONCEPTS
  - —LOGISTICS SUPPORT
  - —DETERRENCE
- LARGE U.S. INVESTMENT ALREADY COMMITTED AND PRODUCING RESULTS

THE B-2 ADVANTAGE

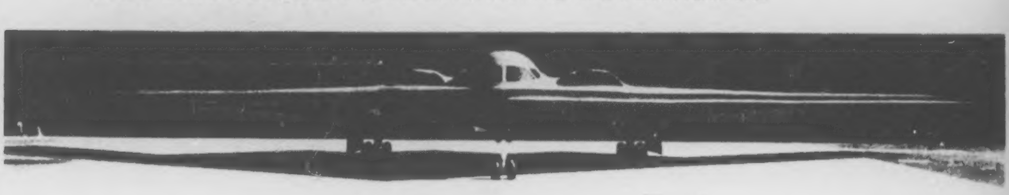
- o As the 21st century rapidly approaches, we must support our vision of the future by making the tough investment decisions today.

- o Considerable resources have already been committed in developing this revolutionary technology for the B-2 program. It would be foolhardy not to capitalize on this major investment.

CONCLUSIONS



- TRIAD WORKS TODAY
- ARMS CONTROL INCREASES EMPHASIS ON THE BOMBER LEG
- BOMBER FORCE AGING
- ALL-STANDOFF FORCE WOULD BE SEVERELY LIMITED
- MODERN BOMBER UNDERWRITES DETERRENCE



CONCLUSIONS

- The Triad has served us well.
- A decision to deploy the B-2 will not only capitalize on our previous investment but will preserve the integrity of deterrence policy which the B-2 underwrites.

Secretary Rice. I have an opening statement, Mr. Chairman, and General Welch also has one, and then we will stand ready for your comments.

Mr. Chairman, 46 years ago today off the coast of Normandy the largest amphibious operation in history initiated the beginning of the end of World War II. I mention this not just because of the coincidence of the date, but the concept is fundamental. We must not forget that the suffering and devastation in that conflict resulted from a failure of deterrence. A failure to deter war today would make the horrors of World War II pale by comparison. We simply cannot afford to take that risk. And in a nutshell, that is why we need the B-2.

The B-2's mission is deterrence of conflict, both nuclear and conventional. As an element of our triad of nuclear forces, the B-2 will take its place as the backbone of our bomber force, the most stabilizing and flexible element of those nuclear forces. The B-2 will enhance our capabilities to project conventional power, rapidly against any location on the planet to deter adversaries from threatening our interests and to help keep smaller conflicts in this uncertain world from spreading to become larger ones.

The fundamental goal of the United States in shaping the nuclear balance between the superpowers is to increase stability, to reduce incentives for either side to launch an attack. The manned penetrating bomber force is the most stabilizing element of our strategic forces. It ensures any aggressor that an attack will be met with devastating retaliation, while its slow speed relative to ballistic missiles means that it does not pose a first-strike threat.

Bombers thus enhance deterrence while simultaneously increasing stability.

Penetrating bombers like the B-2 work together with cruise missile carriers to greatly complicate an enemy's defensive problems. The Air Force strongly supports a mixed force. But converting to a pure cruise missile force, as some have recommended, would allow Soviet air defenses to focus their efforts on shooting down the nonstealthy cruise missile carriers before these aircraft could launch their weapons, and permit them to focus terminal defenses to deal with cruise missiles, even stealthy ones, which cannot react to defenses or other changes in the environment.

A pure cruise missile force is less capable, less flexible, and inherently more risky. That is why we require a mixed force of standoff and penetrating bombers. They work together to enhance deterrence.

The B-2 is essential to maintaining the penetrating bomber capability into the next century. Initial results of the congressionally-sponsored study by the Institute for Defense Analysis reinforced this overall conclusion. B-1s cannot successfully substitute for B-2s, especially against heavily defended targets. And B-2 performance, on the other hand, is relatively insensitive to fairly dramatic changes in assumptions about the potential threat.

The flexibility and adaptability of the bomber force is reflected in the fact that it is the only element of the triad that can be employed in conventional operations. The B-2's unique capabilities in projecting conventional power, long range, high payload and high survivability, will become even more vital in these times of international uncertainty, rapid change, and reduced forward basing.

Its stealthy characteristics obviate the need for many additional support assets needed to project power using other conventional means. B-2s could strike any location on the planet from secure bases within a matter of hours, thus providing exceptional deterrence. No adversary could remain beyond the reach of our B-2 force.

The B-2 will therefore be one of the Nation's premier power projection assets in an era in which that sort of capability will become even more important.

Would we risk the B-2 in conventional operations if its capabilities were needed?

Well, consider the SR-71 strategic reconnaissance aircraft, the most expensive operational aircraft of its time. It was routinely flown into high-threat areas because of the importance of the mission and our confidence in its survivability. The costs of the SR-71 were due in large part to its unique capabilities which, in turn, conferred a high degree of survivability. The same logic applies to the B-2.

We are not eager to employ any weapon, but if needed, we will use the B-2.

Successive administrations and congresses have supported the development and deployment of this system because of the cold, pragmatic recognition that stealth technology is the most significant military technology to appear since the advent of radar and the atomic bomb, and one in which the United States enjoys an unprecedented lead.

There is no question that our next generation of tactical fighter needs stealth technology in order to successfully survive and carry out their essential missions, and there should be no question that our future high payload, long-range bomber force also needs to exploit stealth to remain survivable for the long term.

The Secretary of Defense's recent exhaustive review of major military aircraft programs, which was briefed to you in April, confirmed the essential need for the B-2. But several factors led to Secretary Cheney's and the Air Force's conclusion that the buy could be reduced from 132 aircraft to 75. Changes in the target base, promising developments in the international scene, and more constrained defense budgets all played a role in his decision.

The changes in the B-2 program reduce its overall total cost and reduce the annual funding request. But 75 is the minimum number of aircraft required to field a significant combat capability for the long term.

Creating a revolutionary weapon like the B-2, which has already influenced the design and manufacturing process for future aircraft, required large expenditures on research and development. Now is the time to reap the benefits of these years of progress in technology. We must focus on what is left to be spent, not what has already been spent, to capitalize on this investment.

To complete the 15 aircraft currently authorized and then stop means the Nation would have spent over $35 billion to produce almost no combat capability. This is what opponents who recommend terminating the B-2 program are in fact proposing. To acquire the additional 60 aircraft and essentially all the combat capability, we need an affordable incremental investment of $26 billion in then-year dollars.

The new B-2 procurement program under this revised plan will account for an average 1.1 percent of the DOD budget, less than the B-52 and less than the B-1B when they were being procured.

In terms of cost-to-go from fiscal year 1991 forward, the B-2 costs less than at least a half a dozen other major defense programs.

The flight testing for the B-2 has proven extremely successful, reflecting the fact that the B-2 is the most tested aircraft in history. The aircraft has proven stable and responsive. The test pilots have likened its handling to that of a fighter. Flight tests have identified only a few minor difficulties of the type such testing is expected to uncover.

We will begin low observability testing later this year. Our prediction capabilities, developed over years of experience with other stealth platforms, are very good. We anticipate no problems in the B-2 meeting its low observability requirements.

But, Mr. Chairman, I would like to emphasize you have my word, if that testing fails to demonstrate adequate low observability, I will ensure reconsideration of the program.

Mr. Chairman, I want to reiterate the Air Force's commitment to prudent management of the B-2 program. We have made numerous adjustments since last year reflecting the changed strategic environment, the new budget realities, and the status of the development program itself.

These changes include: reducing the quantity from 132 to 75; reducing the peak annual funding from over $9 billion a year to about $6 billion; reassessing the hangar and basing requirements to cut those costs dramatically; planning for higher alert rates and extended operating life of the smaller fleet to maximize the return on the taxpayers' investment for the B-2. And we have extended, with Secretary Cheney's recent recommendation, low-rate production through fiscal year 1991 to ensure full testing before full-rate production begins.

Mr. Chairman, the revised B-2 program you have before you deserves the full support of this committee and the entire Congress. The B-2 will enhance the stability of the nuclear balance, and it will enhance deterrence for the long term. And the B-2's capability to project conventional power rapidly will become even more vital in these times of global instability and rapid change.

Our planning within the Air Force for the 1990s and beyond, which I presented to you in February in the briefing "Global Reach, Global Power" capitalizes upon the inherent characteristics of air power: speed, range, flexibility, precision, and lethality. The B-2, in many ways, epitomizes air power's inherent attributes. It provides true global reach and deterring global power.

Thank you, Mr. Chairman. And now I would like to turn to General Welch for his comments.

Senator EXON. Mr. Secretary, thank you very much.

I was going to recognize Senator Thurmond, but he has agreed to stay on. So I am very pleased to recognize you at this time, General Welch.

STATEMENT OF GENERAL LARRY D. WELCH, USAF, CHIEF OF STAFF, UNITED STATES AIR FORCE

General WELCH. I thank you, Mr. Chairman, members of the committee. I thank you for this opportunity to discuss the B-2 bomber.

You have already heard much about what the bomber does for security and stability and deterrence, and I need not repeat those important themes at this point. What I will do is focus on what has become a principal focus, and that is cost. But in addition to discussing the real cost of producing the B-2, I will also discuss the cost of not buying the modest number of B-2s now requested.

Let me begin by putting what we have already invested in this program into perspective. Through fiscal year 1990 the Congress has appropriated $26.4 billion for B-2 development and production. And from the development investment will come a stream of benefits for future American aerospace development and production, both military and commercial, for years to come.

You have been subjected to a wide range of cost-per-aircraft figures—total program unit cost, flyaway unit cost given in base year dollars, current dollars, then-year dollars—all impacted by program schedules, production rates, inconsistent funding levels, total cost concerns, annual cost concerns and so on. But since the future budget is such a strong driver of cost concern, what should be especially important to us today is the future cost of the program.

Three months ago the debate was about an airplane that, in total program terms, was to cost an average of $530 million a copy in inflated then-year dollars.

Now the Air Force and the Secretary of Defense have responded to competing national budget demands and a reasonable expectation of conditions permitting a somewhat smaller deterrent force. The total request has been lowered from 132 aircraft to 75. This has, predictably, led critics to divide the total of sunk cost and future cost by the lower number of aircraft, focusing on an even higher average total program cost.

I would repeat the irrelevance of that to discussions about the future. That decision, it seems to me, should be based on the deterrent value and other contributions of the B-2 provided by the remaining investment.

I would point out that the Air Force has submitted proposals to the Secretary of Defense taking $117 billion from the 1992 through 1997 program request. That means we have made lots of tough choices. And in the face of that, the Air Force remains clearly committed to the B-2 program, simply because it seems so clear to us, it is essential to the long-term viability of the airbreathing leg of the deterrent triad.

And there seems to be little disagreement about the importance of that leg of the triad. The consistent U.S. position in the START negotiations has been to move towards greater reliance on the stabilizing influence of bombers, and that bombers have devastating retaliatory power but no first-strike capability and present far less risk of rapid escalation.

That brings me to the cost of not proceeding. I strongly believe the long-term future viability of the airbreathing leg of the triad rests with the B-2. A decision to turn away from a capable B-2 force is a decision to start down the path of eventually losing the effectiveness of the bomber leg of the triad. This is not dramatization; it is a predictable consequence.

The Soviet Union has spent massive sums on the most expensive defensive network ever built, and it is our ability to defeat that massive system of radars, interceptors, and surface-to-air missiles that preserves the great deterrent value of bombers. The B-2 assures that continued capability with such technological advantage that the capability will be enduring. And surrendering such an important advantage in the strategic deterrent arena is a course the country should not take without a very clear understanding of what we have conceded.

The B-2 is a powerful force multiplier. Covering the toughest targets with the B-2 will keep the B-1B viable in the penetrator role into the next century against a wide range of less heavily defended targets. Should the Soviets choose to focus the massive effort required to mount any significant defense against the B-2, they would then dilute the defenses arrayed against both the B-1B in the penetration mission and the B-52H in the cruise missile carrier role, extending and enhancing the effectiveness of those systems.

Conversely, without the B-2, the B-1B must penetrate the tougher targets against focused defenses for the foreseeable future. It will be less and less capable of that over time. Some B-2 targets would be just too tough for the B-1 requiring, instead, multiple warhead attacks by other systems with the other systems limited by START. No B-2 would mean a significant overall reduction in target coverage, reduced stability, reduced retaliatory capability—in short, less confidence in deterrence.

You have heard some suggest that we really do not need to produce the B-2 now, that we could instead develop the technology and put it on the shelf until we need it, using the other triad systems to take up the slack. The fact is that producing a combat aircraft takes far more than technology on the shelf. It takes years of detailed integration work, production tooling, years of integrated system testing, trained experienced manpower; and it takes a tough, experienced, committed management team. And you cannot put that on the shelf. So we have only two choices: keep producing at a reduced but viable rate until we have a capable force, or give up the capability.

I see no viable substitute for the deterrent contribution of the B-2. There is no enthusiasm for greater reliance on the ICBM leg of the triad. In fact, it seems apparent that the next round of START negotiations will further de-emphasize ICBMs. To cover B-2 targets with other systems would require far more warheads, and that is simply not a credible expectation. We cannot add warheads to make up for the loss of B-2 weapons. We can only reapportion the remaining weapons in a less efficient manner; 75 B-2s will contribute about 1,200 highly capable flexible warheads to deterrence. But we gain far more than that.

These 1,200 weapons provide targeting efficiencies, increased survivability for the remainder of the airbreathing force, more flexibility in the SIOP and a more stabilizing force structure. Giving up so many advantages in the deterrent equation would simply make no sense.

Finally, let me say a word about the state of the Soviet threat. I freely grant there are promising changes in the character of the Soviet threat, but they will remain a formidable strategic nuclear force. The capabilities of their strategic offensive and defensive systems are being modernized at a far faster rate than in the United States. They are, in fact, modernizing every facet of that force: bombers, ICBMs, submarines and strategic air defenses.

With the long-standing support of this committee we have performed the strategic deterrent task with the only passing score and that is 100 percent. A crippled bomber leg is not the way to sustain that record.

I thank you for your attention and look forward to our discussion.

Senator **Exon**. Thank you very much, General.

I would just advise the committee that the IDA study that Secretary Rice indicated in his statement would be forthcoming will be presented to this Subcommittee. And I would invite all members of the Senate Armed Services Committee to that very important and highly classified meeting on June 14. That is June 14 and that will be held in S-407. And I would like to suggest all Senators put that on their calendar at this time.

Let me start the questioning then. And I will ask either one of you to reply to this series of questions concerning the revised fiscal year 1991 request for the B-2. Exactly what is the total amount of the request for 1991? How much for RDT&E? How much for procurement? How much for the two aircraft that has now been selected as the procurement number? How much for advanced procurement for next year's buy? How much for initial spares? And how much for Milcon? Can you give us some details?

Secretary **Rice**. Mr. Chairman, I do not have that detailed breakdown with me. We would be more than happy to supply that to you for the record.

As you may be aware, the Secretary described the numbers that were provided with his report of the results of the Major Aircraft Review as best estimates available at that time. We have been continuing to work on the very details that you have just asked about and would be happy to provide them to you for the record.

[The information referred to follows:]

B-2 FUNDING

The following fiscal year 1991 B-2 program funding information on a 75 aircraft buy using the Air Force's "5 x 2" procurement profile (2 aircraft per year for fiscal years 1987 through 1991):

Fiscal year 1991 B-2 funding (TY $B)

RDT&E:		1.751
Procurement:		
Recurrring Flyaway	1.493	
Non-Recurring Flyaway	0.425	
PSE Support	0.414	
Advanced Buy - Debit	0.767	
Advanced Buy - Credit	-0.343	
Initial Spares	0.0	
Total Procurement		2.756
MILCON:		0.141
Program Cost:		4.648
Unit Flyaway Cost:		0.482

Senator **Exon**. Thank you very much.

I assume that the reduction from five to two procurement aircraft for fiscal 1991 has been agreed to by the contractor as sufficient to keep the production line open. Is that correct?

Secretary RICE. Mr. Chairman, I would not say that the contractor has agreed to it. It is certainly the Department's judgment——

Senator EXON. I am not interested in whether he has agreed to the reduction. Does he say that he can keep the line open with just two aircraft being purchased?

Secretary RICE. Mr. Chairman, it is certainly the Department's judgment that the line can be kept open. And, again, we are working on the details of the modifications to the actual acquisition, management and the contracting arrangements that will implement the changes that come about as a result of the MAR review decision to reduce the 132 to 75. But we believe that can be worked out in a way that will keep the line open.

Senator EXON. Well, I would just say to you, Mr. Secretary, that I know there is an awful lot going on over in the Pentagon today. I know it is a very difficult period, making the reductions that have to be made, but it has now been 6 weeks since the Secretary of Defense himself indicated the reduced buy. You know, this and the statements that I made earlier about just not getting the information up to us indicates to me that there must be a lot of unanswered questions in the revised Air Force budget request.

And I only tell you that we are under a great deal of pressure here also with mark-up coming soon. We just cannot do an intelligent job of making these decisions unless we have this information from you. I would hope that you can take back the message loud and clear to the Pentagon that we do need this budget information, and we need it very soon.

Dr. Rice, table 1, on page 19 of your statement contains a note which says, and I quote: "Cost data for the 75 aircraft was derived from the Secretary of Defense' recent Major Aircraft Review." I find this a rather curious note. Does this mean that when you run the Air Force's B-2 cost model-run, you come up with $61.1 billion as the total program cost?

What do your models show as to the total program cost for the 75 aircraft that must be available? And, of course, that would depend on what kind of a schedule is set forth for the procurement of 75 planes in Mr. Cheney's report.

These are just some of the questions that I have. I hope you will understand how difficult it is for us to fit this program into a mark-up without more information than we have now. Do you understand our predicament?

How soon can you alleviate this lack of information?

Secretary RICE. I understand very clearly the predicament that you have. The point I was going to make a moment ago is that unfortunately the devil is in the detail. At the total level there is reasonably close agreement, though there are still some differences between the results of the model runs that you are asking about for the total program cost estimate and the numbers, and the $61 billion, that you have cited.

There are a large number of assumptions that have to be worked through having to do with the timing, as you suggested, of the procurement quantities, having to do with whether or not a multi-year buy is assumed and, if so, at what point in time in the production schedule, having to do with the way that support equipment and spares and other things are provided for. We simply do not have all those details resolved for the new 75 aircraft program.

We are working them inside the building, and I will carry back the message that you have just delivered to us. In fact, I will make sure it is personally delivered to the Secretary because, as you know, what we are talking about here are effectively revisions to the President's budget request. Those are not things that the Air Force can unilaterally produce. They have to go through the process in the building and the administration.

I understand very clearly just what you are referring to and just what you are up against, and we will get that information to you absolutely as rapidly as we can. I will try to light every fire under it we can back at the building.

Senator Exon. I assume all these programs are tied up together when you look at the total budget, but I addressed earlier the fact that we are just not getting the information on another very expensive program, SDI.

If the $61.1 billion is not the right answer, this committee wants to know about it. We are not going to go to the floor of the Senate and fight for the program only to have the usual procedure followed where next year the administration comes back with some sad story about higher costs. We want to know as best we can as to what your definitive answer is, and we need that very soon.

Dr. Rice, do you agree that at least as far as you know now with the right to change it at a later date, the $61.1 billion is the most realistic estimate for the program that Secretary Cheney outlined?

Secretary Rice. Mr. Chairman, at this point our best belief is, with the caveat I have suggested, we are still trying to work our way through all of those details where the devil is. We believe that the total program cost estimate will be slightly higher than that. I would use a number around $62 billion if you press me for a number today; not much different. It depends on the exact schedules and all the assumptions to which I was alluding before. We are trying to get within the building an agreed layout of the program plan and all the details that have to be specified in order to come up with an estimate that everyone buys into. That is the process we are engaged in at the moment.

The Air Force numbers are slightly higher than those that were provided in the MAR review, and we are working closely with the OSD staff to try to resolve those matters and get you a best estimate from the administration.

Senator Exon. Thank you, Mr. Secretary.

One last question in this round for me. General Welch, how much higher than $61.1 billion, in your view?

General Welch. I think the Secretary's number is the right number. Around $62 billion is the Air Force number.

Senator Exon. Thank you. My time is up. Senator Thurmond.

Senator Thurmond. Thank you, Mr. Chairman. Mr. Chairman, I ask unanimous consent that my opening statement which I will now present follow that of the Chairman of the subcommittee.

Senator Exon. Without objection, that is so ordered.

Senator **Thurmond**. Mr. Chairman, I want to join you in welcoming Dr. Rice and General Welch today to discuss the B-2 bomber program.

General Welch, I understand this may be one of your last appearances before this subcommittee. I want to say I am grateful for the service you have given your country and especially for the assistance you have given to this subcommittee.

Mr. Chairman, this is a very important hearing. It may be the most critical hearing we will have this year, for at stake is the clear and single principle that has guided this subcommittee since it was established. The United States must always have a strategic deterrent that is undeniably powerful and survivable so that the Soviets will always know that they, the leaders and organs of state power, face sure and rapid destruction if they ever unleash a nuclear war.

Why do I say that this principle is now at stake? Because unless we decide to modernize now, we will enter the next century with an older force, a compromised force, a force vulnerable to Soviet defenses. Decisions we make now will determine the effectiveness of our triad for years to come. We have to modernize. As Senator Warner has said, arms control does not mean strategic atrophy.

While the United States is arguing, the Soviets understand this perfectly. With all their problems, with their economy in shambles, with their military budget plummeting, with their forces in entrenchment in Europe, with their cities plagued with ethnic unrest, the Soviets are moving ahead. I want to repeat, they are moving ahead at top speed to modernize their strategic forces. Strategic forces count. The Soviets know this. We should know it, too.

What are we doing? We are arguing whether we will have a mobile ICBM or not. We are questioning whether DOE will be able to make warheads for the Trident. We quibble about crisis stability and cost effectiveness at the margin, and we talk about abandoning the most important development in military technology in years, the Stealth bomber.

Mr. Chairman, I hope we do not lose the fight for this bomber. We know that the Soviets have not in the least slowed up their research to defeat our strategic forces. That is why we have always relied on the triad. If we stop the B-2, we give away one leg of the triad. Then we will be relying on ICBMs and submarines. We know the Soviets can destroy our ICBMs in our silos. Can we be sure they will never find the Tridents?

Dr. Rice and General Welch, I hope you can help this subcommittee come to grips with this issue today. Although I agree with you on the need for the B-2, I am very concerned about the cost of the program at a time when we anticipate large reductions in defense spending.

Mr. Chairman, I have a few questions I will propound until my time is up.

General Welch, is it true that the Soviet AWACS will not be able to see and track the B-2 unless you fly right at it?

General **Welch**. That is quite true. In fact, the B-2 will be able to detect the Soviet AWACS well before the Soviet AWACS can detect the B-2, making it a virtually impossible job for the Soviet AWACS.

Senator THURMOND. General Welch, do I understand correctly that Soviet interceptor fighters have a better chance of blundering into the B–2 than of finding it by radar?

General WELCH. The fact is that the radar detection range of a fighter-borne radar against the B–2 is about the same as the eyeball range, which puts it in the category of a chance encounter or whatever you could do with the eyeball. That is correct, sir.

Senator THURMOND. Secretary Rice, a publication provided to me by a group that is opposed to the B–2 listed the 25-year life-cycle cost of the B–2 as $155 billion. According to the publication, this cost figure is higher than that of the Trident II submarine.

Does the Air Force agree with this dollar cost? If not, what is the Air Force estimate of the 25-year life-cycle cost for the B–2?

Secretary RICE. Senator Thurmond, I would be happy to provide the 25-year life-cycle cost as the Air Force's best estimate for you. We certainly do not agree with the estimate, as I recall, from the publication that you cite.

I simply point out that this is a rhetorical game that is often played. You can make the cost of the system anything you want it to be by choosing how many years of operation one must add into the cost estimate. That is not the typical way in which cost estimates are done and compared across systems, but we will be happy to get you the best Air Force estimate of the total life-cycle cost with 25 years of operation included.

[The information follows:]

B–2

The Air Force estimate for B–2 variable Operations and Support (O&S) cost is $15.7 billion (fiscal year 1990 dollars). This is based on a 9-year phase-in period from first to last delivery and a 25-year steady state period of operations beginning after delivery of the last aircraft. The B–2 operations concept has been revised to include a new alert rate of 55 percent, almost double the currently anticipated rate of 30 percent. O&S cost estimates include unit mission personnel, unit level consumption, depot level maintenance, sustaining investment, installation support personnel, indirect personnel support, other depot activity, and personnel acquisition and training.

Senator THURMOND. Secretary Rice, some have claimed that the decision to reduce the procurement of the B–2 to 75 aircraft was a budget decision and did not consider the military needs.

Would you please address that allegation?

Secretary RICE. I will, Senator Thurmond, and I will ask General Welch to comment on it as well.

As I said in my statement, there were several factors taken into account. One clearly was the changing geostrategic situation, the changing international situation. Another was the factor of a changing target base with the changes that are going on in Eastern Europe. Yet another was obviously the budget pressures and the need to adjust to significantly lower total funding levels and to set priorities within that. Yet another factor was to try to understand a kind of minimum essential combat capability.

All those factors came together to produce the judgment on the part of the Air Force and the Secretary of Defense that we could reduce the buy to 75 aircraft.

I think General Welch may want to comment on that as well, sir.

General WELCH. I would be pleased to.

As you may recall from earlier testimony, the original number of 132 was arrived at from the 230 total penetrating bombers required to give us the most efficient coverage of the targets. We built 100 B-1s, and we were going to build 132 B–2s. In revising the number, we looked at three factors. One, of course, is that some of those targets with the changes in Eastern Europe are no longer regarded as required.

Second, our criteria this time for what is really the minimum number of B–2s, not the minimum number of penetrating bombers but the minimum number of B–2s, was predicated on those particular targets as particularly difficult targets that really need that kind of capability. That, taken together with a viable size force from a logistic support standpoint led us to 75 as the minimum number.

So it has changes in the world factored into it. It has B–2-peculiar factors in it, and it also has some logistics considerations factored in.

Senator THURMOND. General Welch, am I correct in understanding that the Soviets may be able to detect the B–2 but that they will not be able to track it, and this means they cannot shoot it down?

General WELCH. Senator, the defense problem is a four-step problem: You must detect the target; you must be able to track it with enough fidelity to guide something to it; you must then be able to guide a kill mechanism; and whatever you use against it must be able to fuze based on its detection of passing the target.

It is very clear that you can build radars that can tell you that there is something out there, so you can detect the B–2s with some radars at some ranges clearly. We have a red team that has worked on this since 1979, and we have looked at every scheme, real and imagined, that anyone has presented to us. We can find no way to detect, track, guide to and fuze against a B–2.

Senator THURMOND. General Welch, penetration of Soviet air defenses is claimed to be a prime capability of the B–2. Are there any indications that the Soviet Union is acting to counter that capability?

General WELCH. At this point in time, we see nothing going on that we regard as particularly directed against the B–2. Let me add that the Soviets do continue to upgrade their air defenses. There are some parts of their air defenses that will help with effectiveness against any kind of penetrating aircraft, or any kind of penetrating cruise missile. It still does not constitute anything that looks like a system aimed at a significant defensive capability against the B–2.

Senator THURMOND. General Welch, I would like to clarify one thing. If we do not build the B–2, is it true that the Soviets could concentrate an effective defense far forward in the Arctic to hit our cruise missile carriers before they launch?

General WELCH. I think it is fair to say that without the B–2, clearly the Soviets will be able to focus much more effectively against the remaining penetrating bombers. That means over time it will become more and more difficult for the penetrating bomber to be a part of the equation. If the Soviets then elect to restructure their efforts at cruise missile carriers, then it is our prediction that the Soviets could reduce the effectiveness of the overall bomber force by about three-quarters over time.

Senator **Thurmond**. Dr. Rice, so far we have always concentrated on the B-2 as a pure nuclear deterrent, but in the future we may well have too few nuclear weapons to cover all the targets we need to hit, and some of these targets, like radars, are really quite soft. Do you believe that there is a role for precise, nonnuclear strategic weapons on the B-2?

Secretary **Rice**. Senator Thurmond, I believe very strongly that one of the most appealing features of the B-2 is the capability that it would offer for long-range, quick reaction, conventional strike capabilities and certainly we would be using both precision and more standard weapons, depending on the nature of the target that was required for employment by the B-2.

It could employ advanced cruise missiles. It could employ cruise missiles. It could employ shorter-range precision weapons, or it could employ more standard conventional munitions. We have not yet begun any planning for the incorporation of conventional weapons into the strategic nuclear response, into the SIOP response, but certainly in non-SIOP missions the conventional capabilities we believe are very important for our future planning.

Senator **Thurmond**. General Welch, I just have one last question. In the case study on the B-2 the Air Force provided to the committee, there is a statement which intrigues me. The statement is, and I quote, "In short, its [the B-2] very existence could deter aggressors from threatening the security of the United States and allied nations around the world."

Now, the question is, if the B-2 is such a threat, why have the Soviets not insisted on greater restrictions on our bombers during the START negotiations?

General **Welch**. I think, Senator, there was a clear objective in the START negotiations from the beginning to move towards a more stabilizing force. You may recall that there was a point in time when it was even proposed that we would get rid of all ballistic missiles. Now of course, that turned out to be wishful thinking, and it really was not a doable thing, but the point is that from the very beginning of the START negotiations the focus was on more stability and it was recognized by both sides from the outset that since the bomber is clearly a retaliatory weapon it has no first-strike capability, that moving toward more emphasis on the bomber was the right way to go. So I think that starting out with that objective and that philosophy, both sides have simply accepted the fact that the bomber is the preferred and absolutely necessary deterrent on both sides.

Senator **Thurmond**. My time is up. Thank you, Mr. Chairman.

Senator **Exon**. Thank you, Senator Thurmond. Senator Levin?

Senator **Levin**. Thank you, Mr. Chairman. Our Chairman asked you, Mr. Secretary, for the cost for the new budget request for 1991, and asked you if you would break it down, and you are unable to do that. I wonder if you could give us what your new request is going to be in total. The original request is $5.5 billion for five planes. Can you give us the approximate new request for the two aircraft total?

Secretary **Rice**. Senator Levin, that is also part of the on-going work we are trying to do in the building to get the details straight.

Senator **Levin**. Do you have an approximate figure today? If you do not have figures, can you give me a bottom line?

Secretary **Rice**. We believe that the fiscal year 1991 request as included in the President's budget can be reduced about $900 million.

Senator **Levin**. So we can expect that will be in the range of $4.5 billion?

Secretary **Rice**. Yes, sir.

Senator **Levin**. Now, on the statement that you have given us on page 21, if you would turn to that I want to go through some numbers with you, because I, too, am very troubled by the cost of the B-2 program. You state there about 10 lines down that opponents who recommend killing the B-2 are proposing to spend about $35.4 billion. That figure is made up of two figures, the sunk costs of the $26.7 billion plus $8.7 billion which is what would be needed to complete development testing and refurbishment of the five full-scale development aircraft, and then that would give us a total of 15. Is that right?

Secretary **Rice**. Senator Levin, it would include the completion of the RDT&E, which would include the fitting out of the five RDT&E aircraft. It would also include all of the test program and it would obviously also complete the 10 production aircraft that are already funded, so in principle it would deliver 15 aircraft for $35.4 billion.

Senator **Levin**. Would that also include, according to footnote 1 if you look at the bottom of page 21, the termination costs?

Secretary **Rice**. Yes, sir. That is all included in the $35.4 billion.

Senator **Levin**. So that $8.7 billion there includes the termination cost?

Secretary **Rice**. To the best we can estimate it at this time, yes, sir.

Senator **Levin**. Now let us look at your total program costs. If we go ahead and build the 75, that total program cost is $61 billion approximately, to your best estimate at the moment, and that is made up of three figures. If you will work this through with me, if you look at the paragraph that says the best way to think about cost is to—do you see that paragraph near the top? Page 21?

Secretary **Rice**. Yes, sir.

Senator **Levin**. Okay. First, we have sunk costs of $26.7 billion, correct?

Secretary **Rice**. Yes, sir.

Senator **Levin**. Then we have got the $8.7 billion, and then we have got, under the Secretary of Defense's proposal to acquire—the additional 60 would require an incremental investment of $25.7 billion. Do you see that? That figure?

Secretary **Rice**. That gets you to the $61.1 billion.

Senator **Levin**. Now, the problem is this, that $61.1 includes your $8.7 billion, which in turn includes your termination costs of $3.6 billion by your own testimony. Why would you include termination costs of $3.6 billion in your total program cost of $61.1 billion?

Secretary **Rice**. $25.7 billion is only intended to be a simple arithmetic calculation of the incremental cost it would take to support the 75 aircraft program as compared to what would have to be spent to complete a 15 aircraft program, so it is straight arithmetic. There is in a sense an overlap in them. The moneys that are included in the $35.4 billion that would go for termination would not go for termination, they would go for production against the 75 aircraft program.

Senator **Levin**. So the additional 60 aircraft would require an investment of more than $25.7 billion if we completed the 75 purchase?

Secretary **Rice**. If we did not terminate, that is right.

Senator **Levin**. It says under the Secretary of Defense's proposal to acquire a total of 75—that means we are not terminating—the additional 60 aircraft would require an incremental investment of $25.7 billion. That is not accurate.

Secretary **Rice**. No, sir, it is accurate.

Senator **Levin**. The general is saying it is not accurate. Let me ask the general. Is that an accurate figure?

General **Welch**. It is accurate as described. It is simply a subtraction of the one number from the other, and that is an accurate subtraction. I guess that is all I can say about it.

Secretary **Rice**. We are attempting to cite the incremental investment that the Nation would have to make to get to 75 compared to what it would have invested if the decision were to have been made to stop at 15. That is all. Senator Levin——

Senator **Levin**. I would suggest you take a look at these numbers, because the way you have laid them out here to get to your $61 billion, you include $8.7 billion, which in turn includes termination cost. It is not the accurate or clear way to lay out the cost of the program, but if you say that the $61 billion does not include termination cost, that is fine, give us the revised numbers that gets you to $61 billion without that $3.6 billion.

Secretary **Rice**. Senator, if I could just interject one thing, I did, in responding to Senator Exon, note that the Air Force estimate at this point is somewhat higher, more like $62 billion—62 point something.

Senator **Levin**. I understand. Could you just quickly tell us what the comparative operating costs are for the B-2, B-1 and the B-52 on an hourly basis? What is your hourly operating cost comparison, roughly?

Secretary **Rice**. We do not have those figures with us, Senator. We will be happy to provide them for you for the record.

[The information follows:]

comparative operating costs

	B-52H	B-1B	B-2
PAA	84	84	68
Total Annual O&S Cost	636.7	647.6	536.7
Avg Cost/PAA ($M)	7.6	7.7	7.9

Senator **Levin**. Could you give us an approximate? For instance, is the B-2 significantly more?

General **Welch**. The B-2 will be operated in a significantly different fashion than the B-1, in that the B-2 will operate at a much lower peacetime operating tempo than the B-1. We will make much more use of simulators and much more use of companion trainers, so that means the cost per hour of actually flying the B-2 will be somewhat higher than the B-1. However, the cost of maintaining the B-2 on alert will be considerably lower than the B-1, so that is why it is a little difficult to make that direct comparison.

Senator **Levin**. If you would provide the best comparison you can for the record, I would appreciate it.

Thank you, Mr. Chairman.

Senator **Exon**. Thank you, Senator Levin. Senator Cohen.

Senator **Cohen**. General Welch, my understanding is that the Air Force has not yet done the low observable radar testing and that what has been done has been computer modeling, but the actual testing has not yet been done. Am I correct in that?

General **Welch**. We have done a great deal of testing against an actual model. We have not done the low observable testing against the actual flight vehicle.

Senator **Cohen**. General Welch, I was intrigued with an answer you gave, I believe to Senator Levin. You said both sides were accepting the fact that the bomber is a more desirable weapon, meaning the Soviet Union and the United States. It is more stabilizing and is a second-strike weapon as opposed to being a first-strike weapon. Is it your understanding that the Soviets are increasing their production of Blackjacks rather than moving towards increased production of ICBMs?

General **Welch**. They are not increasing production of ICBMs, they are modernizing their ICBMs.

Senator **Cohen**. They have produced the SS-24, the SS-25, they propose modernizing the SS-18, they have the SS-19. The question I have is, is it your understanding that they are moving to a larger production of a bomber force, compared to a survivable ICBM force?

General **Welch**. Well, of course START constrains that. It is my understanding that they will field 4,900 ballistic missile warheads and a total bomber count of 1,100, because that is what START will allow. So that is where they are headed.

Senator **Cohen**. My question is what are the Soviet's plans, as you understand it? Are the Soviets moving toward a greater reliance upon the bomber force as a second-strike weapon, a more desirable weapon for their strategic needs?

General **Welch**. More than in the past, the answer is yes. However, the Soviets are building the new Blackjack bomber. They are continuing to field the Bear-H, both with standoff weapons, and the Blackjack with the penetrating capability.

However, the total number of countable weapons that the Soviets will have is the same as what we have, and that is the 1,100. But they continue to produce two new bombers, and we see no indication but that they will continue to produce those two new bombers.

Senator COHEN. But your understanding is the Soviets feel that the bomber force is a more desirable force to have under the START regime?

General WELCH. Certainly, that was their opening gun in the negotiations.

Senator COHEN. The second point I would like to point to, or at least ask you about, is you indicate that it is not the cost that really is the crucial issue here, but rather what would be lost. I think, Secretary Rice, you indicate that is the way we should look at this, not what the remaining cost would be, but rather what we would lose as a result of terminating the program as of this time.

Is there nothing salvageable from the R&D of this program?

Secretary RICE. Senator, there is quite a lot of technological advance that has already been transferred from this program to other new aircraft programs. And so there is no doubt that the tremendous investment that we have made in research and development here will bear fruit in probably all future aircraft development programs.

And what I think General Welch and I have both been referring to is getting a return, in terms of combat capability in the bomber force, out of the investment that has been made.

Senator COHEN. General Welch, you indicated that the viability of the triad rests upon the B-2. Would you not also make the statement that the viability of the triad rests upon a survivable ICBM?

General WELCH. I would think the viability of the triad will, yes, I would.

Senator COHEN. And the viability of the triad rests upon having an SLBM force?

General WELCH. Yes, certainly.

Senator COHEN. Now you indicated that this weapon is more stabilizing, obviously because it is not designed as a first-strike system, but let us assume the worst happens, that a strike is launched by the Soviet Union against the United States. What is the principal mission that you envision for the B-2 or the bomber force, period?

General WELCH. Well, you have just described a failure of the principal mission.

Senator COHEN. Right.

General WELCH. The principal mission of the triad is deterrence. And I think that before we talk about what happens if deterrence fails, it becomes rather——

Senator COHEN. What I am trying to come to is what would be the mission under those circumstances because we have had various rationales advanced. One would be for the bomber force to respond at that point by hunting down mobile missiles. Another would be to look for silos that perhaps are empty but are capable of being reloaded.

It seems to shift from time to time in terms of the argument. What do you foresee as the principal missions of the B-2, assuming deterrence has failed?

General WELCH. What you are asking for is what kind of targets are covered by the B-2, and that is the answer to your question. Let me talk generically, because obviously in this kind of hearing we cannot talk specifically.

The penetrating bomber provides the most efficient way to cover a number of classes of targets. One class are those targets requiring a high-yield, very accurate weapon, since the penetrating bomber delivers the best combination of yield and accuracy. A second class is the large area target that again is covered by a high-yield weapon. Again, only the penetrating bomber delivers that kind of weapon.

Senator **Cohen**. You are saying that the penetrating bomber has a higher yield, more accurate weapon than the MX?

General **Welch**. Yes. The combination of yield and accuracy is considerably higher yield than any other weapon.

A third class of targets against which the penetrating bomber is targeted is that class of targets that is so important that you need cross-targeting or more than one warhead, simply because you hedge against a failure of any given weapon system or the failure of any given element of that piece of the triad. And against those targets the penetrating bomber is obviously the preferred weapon, since it can evaluate the condition of the target before expending the weapon, which increases the flexibility on the number of targets that can be covered in that class.

A fourth class of targets are not mobile targets, I have not gotten to that yet, but imprecisely located targets or targets that may or may not be occupied. There are a lot of maritime facilities that obviously fall into that category, and there are some airfields in that category. And again, the manned penetrating bomber can evaluate before expending one of the limited weapons.

And then finally, I suppose the fifth class of targets would be the truly mobile targets. And the penetrating bomber provides the best potential against those kinds of targets. But I hasten to add, we have not made the remaining investments required to have high efficiency against those kinds of targets. That decision has simply not been made that we should do that.

So it is the classes of targets, I think, that are more important.

Senator **Exon**. Thank you, Senator Cohen. Senator Glenn.

Senator **Glenn**. Thank you, Mr. Chairman.

Let me just follow up on Senator Cohen's comments there, because I have been a little confused, too, about what the purpose is on this.

And, Secretary Rice, you are talking this morning for the first time, at least in my memory, and I think very well, about the conventional role that this airplane can fulfill. I have backed the triad concept, but I have always thought it was a little bit weak in that if we really get into an all- out nuclear exchange, where you have ICBMs going, SLBMs going, ALCMs, SLCMs, and everything else going back and forth, nuclear explosions going off all over the place, targets that we have had selected for a long time under attack, with all that all-out exchange already going on, that we would then send a manned bomber in, in addition to all of that. I have always thought that was a little weak.

But I thought we could really support the airplane in the fact that any future war is probably going to start as a conventional war and we need a heavy bomber. And whether it is in the Persian Gulf or the Strait of Malacca or the traditional emphasis on SIOP or whatever, you have sort of got the nuclear part of this thing for free, because you already have any target worthwhile in the Soviet Union pretty well covered by other means, and this would be sort of a third means of doing it.

So I have looked at this from its conventional role. So I am glad to see you stressing that this morning. You have mentioned the conventional role several times.

Back on the talk about budgeting here this morning. I have a great sense of deja vu here this morning. We have sat for the last 2 years in B-2 hearings going through exactly this same drill, not being able to get the cost figures that we think we need to recommend to the full Senate whatever it is we are going to recommend.

And this has been the history of the B-2 program. We have been unable to get information about costs and accurate costs, and something we could hang our hat on. We have asked for those repeatedly. We were given the Cheney $61.1 billion figure. I do not know whether that is one we can rely on now or not, but you have already been asked a number of questions about that.

But I just say that we are going down the same old road we have gone through in past years, except it is different this year. We have new budgetary constraints. They are tough. This is a very expensive machine. And I do not think that, as one of the statements here that I read a little while ago, to try and equate it with a Navy frigate or carrier or something like that, those are things used for a whole different purpose. I do not quite think that is a fair comparison.

But, nevertheless, let me get back into what was my concern last year, and that is the concurrence and how fast we are going with the testing program. We have had 15 flights to date. What problems have developed?

Secretary Rice. As I mentioned in summary form in my statement, Senator Glenn, the problems so far have been all minor kinds of things of the sort that you expect this kind of testing to uncover. There was a difficulty in a power drive. There is some minor cracking on an aft deck plate. There are things of that sort which are just the sorts of things that this kind of testing is intended to uncover and which the engineers and the people in the program believe there are ready, straightforward fixes to.

The most gratifying part of the flight test so far actually has been the extent to which the handling qualities of the aircraft have shown to be very good, indeed. In fact it has performed even better than the simulator that the pilots had used in preparing to take it up to begin with.

Senator Glenn. Well, the handling qualities on this are all artificial anyway. It is an artificial control system, so you can put whatever handling qualities you want into it, so that is not a very fair comparison. These are not aerodynamic handling qualities you are talking about, are they?

General Welch. Well, they are in the same sense they are in any modern aircraft, Senator.

Senator Glenn. That is not the answer.

General Welch. The F-16 is strictly a fly-by-wire computer-driven system, and so is the B-2.

Senator Glenn. I know that. But I do not think it is fair to say that it is a nice handling airplane, because that is all artificially designed into it through the computer. What we are interested in is, does the airplane really control through the full area of aerodynamic conditions you put it into? And so far, I think the answer to that is yes, it does, through the 15 flights it has had, but we have not expanded that envelope into turbulent flight yet, I believe. Is that correct?

General WELCH. We have one test point remaining in the basic flight envelope of the aircraft. We need one more flight.

Senator GLENN. Okay, that is basic, straight and level and limited maneuvering, though.

General WELCH. Right.

Senator GLENN. We are just about at the next test, which will get into the real maneuvering and the turbulent aircraft and low-level flight, and things like that, is that correct?

General WELCH. We have done some of that. That has not been completed, that is correct.

Senator GLENN. I noted on the last flight, and this popped out at me, it said you had a flutter problem. Now I do not know what that was, and I did not have a chance to look into that before the hearing, but to anybody that has been in test work, that is a real big red flag as you know. Was that a flutter problem? What was it? Describe it to me.

General WELCH. No, that is a sloppy term. It was not a flutter problem. There was a pitch oscillation at a certain speed that did not damp out. It had to be controlled by the pilot—easily controlled, but it did not damp out. Which indicates that we need a fix in the flight control software in that particular area. It was not a control surface flutter problem.

Senator GLENN. It was not an aerodynamic flutter?

General WELCH. Of the kind that you referred to, no sir.

Senator GLENN. Okay, good.

How many ECPs, engineering change proposals, have there been to date on the airplane? Do you have that figure?

Secretary RICE. Senator, I do not have that figure. I would certainly be happy to try to get it for you.

[The information referred to follows:]

An engineering change proposal (ECP) is a formal contractual methodology that directs the contractor to: (1) do new work, or (2) revise program documentation to match demonstrated capabilities, thereby meeting revised requirements in a cost effective manner. To date, there have been no ECPs as a result of B-2 flight testing.

Senator GLENN. Yes, there was the heating problem you mentioned, I think they are dealing with that; the rivet problem, I think that was a personnel problem as much as anything else, was it not?

General WELCH. Yes.

Secretary RICE. Senator, you are asking specifically about things uncovered in the flight test program?

Senator GLENN. Yes.

Secretary RICE. We will get you a list of that.

[The information follows:]

B-2 FLIGHT TEST

There have been several problems uncovered in the flight test which warrant further development, however, none require formal engineering change proposals. First, in the final checkout for flight test, a contamination problem was identified with the fuel heat exchanger. A temporary fix is in position while the redesign is being worked.

Second, cracks developed in the housing of the Airframe Mounted Accessory Drive (AMAD). These failures were predicted in the lab prior to first flight, and a fix was already identified. All AMADs have been replaced with the new design.

Third, the control surface positions in trimmed flight exceed predictions. The near-term fix to avoid impact to low observable testing is to shift the aircraft's center of gravity, thereby minimizing trim deflection. The long-term fix involves a minor redesign of the control surfaces.

Additionally, minor cracks developed on the aircraft structure associated with the inboard control surfaces. Aircraft configuration during early preflight test is the suspected cause, and fixes have since been applied. A long-term solution is still being investigated.

Next, as expected during flight envelope expansion, minor flight control problems have been discovered. The flight control software is being and will continue to be modified and fine tuned to provide optimum system performance.

Finally, several problems have been identified with the aft deck behind the engines. These include cracks, higher than-expected temperatures, and some material failures. All these problems are probably related to the aft deck's higher-than-expected thermal and acoustic environment. Rather than individual fixes, a team of experts from NASA, GE, AF Labs, and others is looking at an overall fix which would offer the optimum long-term solution.

Secretary RICE. The fasteners concerned, you are quite right, was more a personnel problem than another kind, but it has to be dealt with.

Senator GLENN. Yes, it has to be dealt with, and that is the purpose of the test program.

Secretary RICE. Right.

Senator GLENN. Is to see that all these things are worked out. And one of our problems, as we discussed at great length last year, was the fact that every time a change comes up on an airplane like this, it is extremely expensive, if it is any major mod, to go back and do that on airplanes already produced. So we wanted to cut the rate down, which we did, and made the hurdles, as they were called, last year.

And so that is sort of where we find ourselves at right now. We still do not have the answers, and we still do not have the cost figures detailed out.

Secretary RICE. And we are continuing that low rate for an even more extended period, Senator Glenn.

Senator GLENN. General Chain reportedly stated that 55 percent, over 40 of 75 aircraft, would be kept on alert, that operating costs were so high that pilots would only get two flights per month, and the B-2 would require special maintenance attention like the SR-71. Is that not going to be pretty restrictive on the use of this airplane, General?

General WELCH. I do not think General Chain said any of those things, Senator. What General Chain said was that, because of the nature of the airplane and because we have re-examined our overall training regime, we can do a lot more work with simulators and companion trainer aircraft than we have in the past.

By the way, we can probably also do that with other bombers. So, clearly, it is the cost of this aircraft that has led us to examine an awful lot more carefully alternative approaches to training. But it is not the cost of flying the airplane.

Senator GLENN. Well, I was going to get into some of these quotes and ask for your version of them. They were all in a Washington Post report where General Chain met with reporters at a breakfast meeting on May 5. It is reported in the Washington Post on May 5. You may want to look at that, because in there he is quoted as saying: "Two flights per month, less than half the normal production, operating cost too high to allow more frequent flights." He finished up by saying—and this was in quotes—"We are going to treat the B-2 like we do the 71—SR-71."

You may want to respond to some of those, because my time is up, and we will not have time.

Secretary RICE. Senator, if I could offer, at least, a brief response now and would be happy to provide you more, if you would like. All of that in my view should be taken in a positive context, not a negative context.

The Air Force is working hard to try to find ways to maximize the capability, the output, the result, if you will, from the major investment that the taxpayer is making in this system. By relying more on simulators and companion trainers, we can reduce the extent to which the aircraft itself has to be flown; and that will extend the operating service life of the aircraft. And that is not a negative, that is a positive.

Senator GLENN. I understand the tradeoffs.

Secretary RICE. Higher alert rates and all the rest of it.

Senator GLENN. My time is up, Mr. Chairman. Thank you.

Senator EXON. Thank you, Senator Glenn. Senator Wallop would be next.

Senator WALLOP. Thank you, Mr. Chairman.

General Welch or Secretary Rice, either or perhaps both, what does the proposed agreement to limit the range of air-launched cruise missiles do to the B-2 premise?

General WELCH. Well, it has no impact on the B-2 in that the short-range attack missile that would be carried as a part of the B-2's armament is not captured under any of those provisions.

What the 600 nautical mile or the 600 kilometer limit will affect primarily are future conventional cruise missiles, and that the air-launched cruise missile and the advanced cruise missile are already captured under any definition. And some of the other——

Senator WALLOP. But their range would be limited according to what the Secretary agreed to?

General WELCH. Well, the numbers of those, of course, are far beyond any range limit that we were contemplating, so they are already totally captured. And that agreement allows us the 50 percent discount, if you will. The cruise missile carrier, the B-52H is capable of carrying 20. And each cruise missile carrying B-52 will count as 10.

Senator WALLOP. But limiting the range of those moves the B-52 farther into the range of Soviet air defenses, does it not?

General WELCH. No, sir. The standoff limit was that any missile, any nuclear armed missile with a range greater than 600 kilometers is captured under START. The ALCM and the ACM were already captured under START. So those numbers are limited, and it does not place any further restrictions on anything we intended to carry on the B-52 or the B-1. And of course, the B-2 does not carry a cruise missile, so it is not affected by that.

Secretary **Rice**. Senator Wallop, if I can just add a thought. The range limit is not really a limit; it is a threshold. And if a missile flight profile crosses that threshold and it is nuclear armed, then, it has to be captured under START and in effect its carrier, whatever it is, would get captured in the cruise missile carrier part of the definitions and the counting rules. But that does not restrict how long range a missile we could have.

It only says, if it is nuclear armed and it has a longer range than 600 kilometers, then it has to count against the 1,100.

Senator **Wallop**. That was the case anyway, was it not?

Secretary **Rice**. Yes, indeed.

Senator **Wallop**. What was the purpose of limiting the range?

General **Welch**. It had to do with future types and the concerns about expanding——

Senator **Wallop**. Conventional capability?

General **Welch**.——expanding either conventional or a nuclear capability that could be applied to strategic targets. So it simply limits the future types that can be accommodated under the counting rules.

Senator **Wallop**. If the B-2 is viewed as stabilizing, why do we agree, then, that the SS-26 which in effect the Mod-5 SS-18 is, it is a new missile under all the old counting rules, why do we agree that flight testing can continue? Why is it that it appears that the Soviets continue to deploy SS-24s and SS-25s without going the same direction that we are going into a more stable world of the penetrating bomber?

General **Welch**. Well, of course, I think that the reason that we agreed to those things is we are involved in a negotiation. And our objective is to reduce the number of ICBMs, and the Soviets have agreed to reduce the heavy ICBMs by 50 percent.

Senator **Wallop**. But that 50 percent that they are reducing is the old, less capable SS-18. So that the modern 50 percent is more capable than the former 100 percent, or at least as capable. Is that reasonably close to accurate? And then it continues to be modernized during flight testing for the next—as far as you can see.

I mean, I just wonder why we are the only ones stabilizing?

General **Welch**. Again, the greatest reduction in ballistic missile warheads would be on the part of the Soviets. The fact that they have not agreed to reduce everything is a fact. But the Soviets will reduce ballistic missile warheads more than we will.

Senator **Wallop**. I understand that. But the fact of it is that we seem to be the ones who have committed to the stabilizing role of the penetrating bomber, and they do not.

General **Welch**. I am very reluctant to get in a position of defending the Soviet position. Let me say that——

Senator **Wallop**. I was hoping that you might find a way to defend ours.

General **Welch**. I think we have defended our position very ably in the START negotiations. And we will, in fact, come out with a START negotiation that will permit us the kind of bomber force and the kind of ICBM force and the kind of SLBM force that we think we need to continue to provide robust deterrence.

The question is not whether the START agreement will permit that, the question is whether or not we will agree to fund that.

Senator WALLOP. Well, I understand that's part of the role too, but I think you have to answer the first question fairly adequately before the second one becomes even relevant.

Secretary RICE. Senator Wallop, if I could just add one thought on the bomber issue, which was triggered in my mind by Senator Cohen's questions as well. And that is that, you know, bombers do not go against bombers. Bombers go against defenses. We do not mount much in the way of defenses.

The Soviets do not need the same size bomber force to hold up that end of their triad as we do on our side given the massive investment that they have made in air defenses on their side.

Senator WALLOP. And ballistic missile defenses as well, I might add.

Thank you, Mr. Chairman.

Senator EXON. Thank you, Senator Wallop. Senator Gore.

Senator GORE. Thank you very much, Mr. Chairman.

Just a brief follow-on to my colleague's questions just concluded. On the enhanced capabilities of a modernized SS–18, I think it is useful to ask, enhanced capability to do what? And the answer is to hit fixed silos. If the missiles are mobile or side, then their enhanced capability is mooted, and it amounts to nothing.

I would like to ask on the B–2, when will there be full-scale tests against radar systems?

Secretary RICE. Those will begin this fall, Senator Gore. That is the next round of testing.

Senator GORE. How structured for realism will they be?

Secretary RICE. Well, I am not sure how to—quite to respond to that. They are going to be made as realistic as we know how to make them. And they will be designed with the benefit of extensive experience in this kind of testing that has been done with other stealthy platforms.

Senator GORE. I do not mean the question to be an abstract question. It is my understanding that the test program will begin with basic tests and then move steadily toward realism, so that over a period of time we will eventually arrive at a result that will give the Congress and everybody else making these decisions some way of determining how it does in the test. Now, how long will that take?

Secretary RICE. That segment—the next segment of low observability testing is spread out over several months of time beginning this fall. And it will take some weeks, at least, after those individual tests are run to be able to compile and sort out the data and make an assessment of what actually was there in the way of capabilities.

Some very important things will be learned in the very earliest of the tests, however. You must remember that there is extensive experience, not just with models and scale models and other things of the B–2 itself, but with prior programs. And so there is a great experience base out there of relating the actual physical experience to what the modeling and the other estimating capability had predicted would occur.

And all of that experience is rolled into our design work and our prediction capabilities for the B–2. And if something is much amiss in that, a lot of that would show up really quite early. Now, you are right that in order to check out all interesting angles, different altitudes, flight against different types of radars and detection systems, airborne—aircraft-borne versus ground-borne, the different types of systems, the simulation of different types of systems the Soviets had. It will take a while to track through all of that.

Senator Gore. Well, do we know roughly what its radar cross-section is going to be now?

Secretary Rice. We believe we do.

Senator Gore. I was looking at your materials here, and I cannot quite understand some of it. You presented here the radar cross-section of the alfalfa caterpillar butterfly and the blue-winged locust and the worker honey Bee. Moving up the scale, we have the starling, the pigeon and the mallard, with a picture of the pigeon.

And it moves on up to the radar cross-section of an aircraft carrier. And there is quite a startling contrast between the aircraft carrier and the alfalfa caterpillar butterfly.

I am wondering where on this continuum the B–2 falls. Is it in the insect category, the bird category, or is it still in the aircraft category?

General Welch. It is in the insect category.

Senator Gore. That is impressive. That is impressive.

Is it in the locust category or the butterfly category? [Laughter.]

General Welch. I think we have carried it just as far as we can.

Senator Gore. Now we are into the classified area.

Secretary Rice. We may have already gotten there. It is well down the chart, sir.

Senator Gore. If current schedules are met, according to the GAO which has compiled this report on the B–2 program status and current issues, it says if current schedules are met it will be at least 3 years before critical performance requirements have been fully tested. That is the point in testing where problems are typically discovered. At that time, under the current schedule over $48 billion would have been appropriated. Is this correct?

Secretary Rice. Senator, we do not agree with that assessment. The number of aircraft that will have been delivered basically by the end of flight testing, certainly by the end of any of the kind of testing, that would uncover fundamental problems about the program will be just a handful of production aircraft. There will be a number of others at that point in some state of completion.

The issue that has to be worked is always a judgment call in these programs. There is no way to have absolute zero concurrence simply because one has to construct the flight vehicles to do the testing with. So you have to build some air vehicles in order to actually do the very testing that they are talking about.

The question then becomes what you do next. What has been decided to be done for this program is to keep it at low rate production, two a year basically, for the longest period as far as I am aware of any aircraft we have ever done. This opens up what therefore is the widest window we have ever opened up, where the conduct of testing occurs before we actually turn up the production profile to higher rate levels.

Because of the way the budgeting process works, the administration has to propose and the Congress has to dispose funding levels that will actually be executed in periods of time well into the future.

With the proposal we have made in the 1991 budget to extend it another year at a funding commitment to only two aircraft—and remember, those aircraft are not going to be delivered until probably 3 years after that—we have I think, by any reasonable judgment, taken the concurrence issue off the table.

Senator Gore. Because my time has expired, let me say in conclusion that it seems to me the irreducible facts are, number one, if there is no B-2 then there is no follow-on to the B-52 and the B-1. As you say in your statement on page 10, the bomber fleet will atrophy and penetration capabilities will decline, with implications eventually for the triad.

The second irreducible fact, however, is that the B-2 flyaway costs at reduced buys is $417 million each, if that is indeed the bottom line.

So the issue is whether the United States can afford the differential cost of having the ability to penetrate as opposed to the ability to have standoff cruise missile launches from the B-52 and the B-1. That is the question this committee will have to wrestle with.

I think the conventional mission is a reach, frankly. You talk about the cost effectiveness compared to other programs—but you are talking about the amount of gasoline and the amount of people. You do not talk about the insurance costs. You do not talk about the implications of losing one of these things and the fact that the director of OMB might have to be on board when it goes out to the missions to which it is assigned if it is a conventional mission.

Secretary Rice. There is no need for that, Senator. Just two pilots will be enough.

Senator Gore. We will not have to put Mr. Darman on it?

Secretary Rice. I absolutely commit to you we will not have Mr. Darman on board.

Senator Gore. Then we have some support here on both sides of the aisle, I think.

I want to conclude by thanking the Chairman for the excellent way this whole issue has been brought to us. It is a very tough situation because of the testing schedule, because of the amount of money already committed and all of this.

Thank you, Mr. Chairman.

Senator Exon. Thank you, Senator Gore. Senator Lott would be next.

Let me interject just one point here as a matter of explanation. We get into these technical discussions, and sometimes I think we may go too far in these open sessions.

Let me say I think it should be better understood by all that the B-2 is a stealthy aircraft. It is not an invisible aircraft. All too often I think some people think that stealthy means it cannot be seen. To get back to the insect analogy, I would think from my vision standpoint a lightning bug is invisible. I can see the lightning bug in the dark when it flashes, but if I swat at the flash I am going to miss it because the bug is no longer there.

A lightning bug, therefore, is invisible from the standpoint of trying to swat the lightning bug, and is that not maybe the connotation in which we should be seriously talking about? This is not an invisible aircraft, but it is a stealthy aircraft, and there are going to be some instances that I think we are going to find, even if this airplane performs its stealthy characteristics as designed, that the tests are going to show that it can be picked up, you are going to get some kind of a reading. The question becomes, can the B-2 get through Soviet defenses and accomplish its mission without being totally invisible?

Is that a fair comment?

Secretary RICE. Yes, sir. I think that is indeed a very fair and very accurate and helpful formulation. The aircraft is not invisible, and it is not immortal. It is, however, given its low observable characteristics, very difficult to counter, and that is the key that allows it to go ahead and perform its mission, as you suggested.

Senator EXON. Now just to follow up on this whole line of questioning, which I think can possibly be brought to a conclusion with your answer to this, is it not true that in the stealthiness tests that are going to start this fall, there is a high likelihood, Mr. Secretary and General, that by January 1, 1991, tests that we will have performed will give us high confidence that this aircraft will live up to the stealthy character? Will we be 90 percent sure of the planes capabilities by next January 1, or 80 percent, or 99 percent?

I would like to get a percentage figure from each of you.

Secretary RICE. Senator, we will have very high levels of confidence about a number of key aspects of it. Not all of the full regime, as was asked about earlier, will have been explored.

I would be comfortable with a notion that we should have by that point 80 percent or higher confidence that we know what we are doing in low observables and know what we are getting in low observables. There will be further tests that will have to be done.

Senator EXON. General, could you add to that?

General WELCH. We will have very high confidence on the radar cross-section against the radar frequencies with which we are most concerned, and I will give you very high confidence that the airplane will indeed be able to use those stealth characteristics for its basic mission.

There will still be other frequencies and other aspects that will not have been completed by that time, but as far as the basic radar cross-section against the basic frequencies that we are most concerned with, we will have very high confidence.

Senator EXON. The Secretary said 80 percent. Do you think——

General WELCH. That depends on which of that spectrum you are talking about. I would certainly say no lower than that against the basic radar frequencies that cause us the most concern.

Secretary RICE. Those are the ones that are most key to the mission performance, to which you were alluding, Senator.

General WELCH. I am more optimistic about the percentage for those basics.

Secretary RICE. I was trying to build in a little discount for the fact that there will be other frequencies and things that will not have been checked out. If you want to ask about the ones that we are doing early which are the ones that are most key to understanding the ability to do its mission, our confidence should be higher than that.

Senator **Exon**. It just seems to me that when these early tests are run, if we do not have a very high level of confidence that proves what the airplane was built and designed to do, we are all going to be in trouble. Senator Lott.

Senator **Lott**. Thank you, Mr. Chairman.

Mr. Secretary and General, in the past I have always supported the B-2. This is the first year I have had the opportunity to really get into the sophisticated technology and the missions and all the other things that I am beginning to learn as a member of the Armed Services Committee, but I am still having problems with what happened to the numbers here.

I know the Chairman asked about this at the beginning of the hearing. We were told a very short period ago that we had to have 132. It was absolutely essential. Then, of course, it miraculously dropped to 75. I think the real truth is you were just trying to anticipate the Congress and figured this is about what we are going to get, we might as well cut our losses and go to that.

If you could make that much of a drop in about a 2-month period, then I wonder if you could not go to 32 or a wing with a couple of spares.

I think it is very unclear what the Congress is going to do. We may wind up with 1 wing or even 16. How do you react to that?

Secretary **Rice**. Senator, I would just like to point out that I do not consider that this was all launched as a big surprise. In testimony earlier this year, and even last year, we clearly indicated that we understood that the peak funding levels on an annual basis that were required with the 132 aircraft program were going to be difficult for the Congress to accept. We were told that very clearly by congressional committees.

We testified before, and we indicated we were reexamining the program to see whether we could find ways to alleviate that burden on an annual basis. And we committed at the request of the committees that we would reexamine the issue of quantity. Clearly, after the changes in the international environment and the very different budget environment, all of that had to be brought together to come to a new judgment about relative priorities, not just in the Air Force program but in the DOD-wide program, and the Secretary has been through that in great detail. I think we have quite a strong meeting of the minds at the Air Force level and the Secretary of Defense level on what is the right new program here, and that is the 75.

Senator **Lott**. General, how about 32? What would that mean to you?

General **Welch**. I do not think 32 would be very useful, frankly.

I need to make it very clear that the 75 was not picked as a number to appease the Congress, that the work that produced the number 75 was analytical work. It is based on the nature of the targets. It is also based, of course, on the realities of the budget.

The number 75 was arrived at as where we get good synergism, where we are able to cover a large number of tough targets which makes the B-1 more effective, because it can then handle less heavily defended targets. It is a large enough force so that the Soviets still have to reckon with a significant stealth capability to cover targets, and it is also a large enough force to make it logistically supportable.

So I would think a number like 32 would not be a viable force at all on any of those counts that I have just described to you.

Senator LOTT. Could either of you give me some estimate of the cost growth that the program has experienced since its inception? We have had these numbers continuing to change. Can you give me a percentage, or give me a number per copy from the inception to what it is now estimated to cost per copy?

Secretary RICE. Sir, I am not sure I have got those numbers straight in my memory. You have to do those kinds of assessments in constant dollars, so you have got to fix a year, do them in fiscal 1990 dollars, or base year dollars. Way back to 1981 or 1985 there have been different reference years that have been used.

My recollection is that the 132 B-2 force before we made the adjustments last year to stretch out the low rate initial production longer to allow more testing to go on before the commitments to high-rate production were made had grown in constant dollars from around $36 billion to around $43 or $44 billion in comparable dollars, same-value dollars. That estimate would rise about another billion or $1.5 billion or so for the stretch-outs that have been built in since in order to give us all higher confidence that we know what we are buying before the production turns to higher rates.

So those are the kind of comparisons from kind of a mid-1980s period when the baseline of the program, the design was settled and the baseline of the program was really laid down until this kind of period. What happens, however, when you add in inflation rates, is, numbers seem to keep changing all the time partly because we are required to use in those estimates the inflation rates that are decreed by the OMB for out-year planning for the defense budget.

Historically, those estimates have always turned out to be—those numbers have always turned out to be lower than what actually came to pass. That gets recognized each year, so then every year you get up-dated inflation estimates and the actual then-year dollars, which buy very different things than the dollars of the year the program was planned to begin with. That is part of the reason why the defense budget is a different size than in those earlier years, too, so the numbers seem to keep changing all the time.

Senator LOTT. My time has expired. I wanted to hear the general comment, but I have got one other very important question I just have to get in here.

Going back to Senator Wallop's questions, is our willingness to restrict the range of the ALCMs under START predicated upon the belief that the United States will have a fleet of 75 B-2 penetrating bombers instead of just the B-1B stand-off?

General WELCH. Certainly the overall counting rule is predicated on that, as we indicated in response to Senator Wallop's question. The 600 kilometer versus the 1,000 kilometer, which was the negotiating issue—the negotiating issue was whether or not the limit for new types, or the limit that would bring new types under

START counting rules would be 1,000 kilometers or 600 kilometers. That has nothing to do with ALCMs, because all the ALCMs that we have contemplated have far greater than 1,000-mile range.

Senator LOTT. Let me ask you again, is it predicated on the idea we would have the B-2s? Yes or no?

General WELCH. Yes.

Senator LOTT. What if we do not fund the B-2s, and we have agreed to diminish the stand-off ability of the B-1B? What does that do to the air leg of the triad?

General WELCH. I think from a START negotiating standpoint that all the Joint Chiefs have made their position clear, and that is that if we do indeed not have the B-2, then we have to reassess the military sufficiency of our START position, because the Joint Chiefs' certification of the military sufficiency of the START position is predicated on a penetrating B-2 bomber force in addition to all of the other elements of the triad.

Senator LOTT. Thank you, Mr. Chairman.

Senator EXON. Thank you, Senator Lott. Senator Wirth?

Senator WIRTH. Thank you very much, Mr. Chairman. A couple of follow-up questions, if I might. First of all, Secretary Rice, you said earlier this morning if tests show inadequate low observability I will assure reconsideration of the B-2 program. That is a fair quote from you, right?

Secretary RICE. Yes, sir.

Senator WIRTH. The Navy has been telling us—Admiral Nyquist testified before the Appropriations Committee and when asked about the threat to U.S. surface vessels should the Soviets develop stealth technology, Admiral Nyquist replied "That's why we developed and have fielded the Aegis radar. That's the radar that will give us the capability, the requisite capability against that kind of threat."

That suggests that we ought to therefore have some kind of a competition between Air Force stealth aircraft and the Navy fleet defense, does it not?

General WELCH. I would say not at all, not unless—well, never mind. I would say not at all.

Senator WIRTH. How would we then determine if there is inadequate low observability?

General WELCH. Let me put the two problems in context very quickly. That is, I would agree it is possible, and I think we have made that clear to this Committee before. It is possible if you are willing to make a large enough investment and deploy things with enough density to protect a very high-value target. It is possible to mount a reasonable defense against even a stealth aircraft, particularly with over-water attacks where there is no terrain masking and you have the maximum opportunity to deal with that. On the other hand, concentrating that kind of defense to protect a significant number of land-based targets over a land-based area would simply be prohibitively expensive.

Senator WIRTH. What if you did not mask Aegis and just had a small concentration of Aegis and tested that against Air Force stealth aircraft? Would that not be a legitimate test, to see if you could detect a butterfly as it comes across the ocean?

General Welch. You would collect some interesting engineering data, and you would determine at what range you could actually see cued targets—since we are talking about something you know is coming, at what range you could see a cued target on a stealthy aircraft. You can certainly determine that, but we can't tell you that.

Senator Wirth. That would not be a legitimate thing to do, to see if in fact by a relatively small investment in an Aegis kind of system you would not be able to neutralize the large investment in a B-2? That is not a legitimate kind of a test?

General Welch. No. It is not an applicable kind of test, to put an Aegis radar on a ship at sea and conclude from that whether or not you could easily defend a large number of land targets with that kind of a system. In the first place, at the current time the deployed Aegis system has no such capability. We know how to build a set of radars that can detect even a very low observable aircraft. It is quite a different thing to build a system that can detect, track, guide a weapon to, and fuse against a low observable aircraft.

Senator Wirth. Let me follow up on a question Senator Cohen asked on Blackjack production. There was a recent report that the production of Blackjacks has in fact not increased but has dropped off significantly from what had earlier been projected. Have you seen that report?

General Welch. Yes.

Senator Wirth. You do not agree with that?

General Welch. No, I do not disagree with the report. I have no basis on which to disagree with that report.

Senator Wirth. One of the arguments that is made is that the Soviets are dramatically increasing their bomber capability so therefore we ought to do the same.

General Welch. I have never made that argument.

Secretary Rice. No, sir. Neither of us have ever made that argument.

Senator Wirth. Let me ask you about a statement made recently by General Chain, who said that he would testify against Senate approval of the strategic arms treaty if Congress did not approve money for nearly all 75 B-2 bombers. Is that the Air Force's view?

General Welch. It is my view and that of the Joint Chiefs, already stated, that the current assessment of the military sufficiency of the START negotiating position is indeed predicated on a force that includes the B-2.

If the B-2 is no longer in that force, then obviously that assessment has to be redone. I certainly am not in a position to speak as to the outcome of such an assessment. I can only say it has been the position, and it remains my position, that there would have to be a complete reassessment of the military sufficiency of the remaining START force.

Senator Wirth. Is the summary of that saying no B-2, no START?

General Welch. No. I think that I made the statement very carefully and exactly as I should have. It means with no B-2 we have to start over with the assessment of the military sufficiency of the START force. Now, beyond that there are political decisions and other decisions that are far beyond my pay grade.

Senator WIRTH. Secretary Cheney testified that cuts in the B-2 force were made possible because of changes in Eastern Europe and a diminished potential target list. In response to an earlier question, I believe from Senator Lott, you said, General Welch, that the cut to 75 had been based upon careful analysis. Does this mean that the Air Force or the administration has conducted a review of the SIOP? Does that mean we have taken a very careful scrub of that and determined from that that only 75 B-2s are necessary now?

General WELCH. Of course, there is a continual review of the SIOP, but the reassessment related to the SIOP that allowed us to conclude that 75 was a sufficient number was based partly on reduction on the total number of SIOP targets with the changes in Eastern Europe, of course, but also partly on narrowing our focus to just the particular targets that most require the B-2 and that give the B-2 the greatest overall leverage in the things it does to enable the B-1 and the other kinds of systems, and in looking at that specifically—and that was done by the JSTPS (the Joint Strategic Target Planning Staff)—then the number 75 looks like a good knee in the curve, and it is a force that provides a significant capability that the Soviets must reckon with and it is also a logistically supportable force.

Senator WIRTH. The analysis in a relatively short period of time dropped the requirement from 132 to 75. Presumably, if it appears the Soviet threat declines even more, or further arms control treaties are signed, that 75 could drop again quite rapidly, could it not?

General WELCH. I would presume that the next arms control treaty that you negotiate would not result in reductions in manned bombers but would instead result in reductions in ballistic missiles, and so if you try to project forward to START II, which is all we can do, I presume that the first target will be ballistic missiles, so the manned bomber is likely to become more important, not less important, with further reductions in strategic weapons.

Senator WIRTH. Again to repeat the question, if in fact we drop from 132 to 75 in a relatively short period of time based upon a careful analysis, presumably if the Soviet threat further declines for a variety of reasons, or presumably if in fact we enter in quite rapidly into other arms control treaties, the need for the B-2 could drop again very rapidly?

Secretary RICE. Senator, I think that is a wholly inappropriate conclusion because it ignores the directions we have been trying to go in arms control in the START process from the very beginning.

Further reductions in strategic weapons should come out of the fast flyers very heavily. If they are to come out of the bomber force as well, they will not come in the form of denying the necessity for a penetrating bomber to be able to successfully conduct its mission well into the next century. The B-2 is the only thing that allows us to do that.

So if you look forward to a START II and think about major further reductions in the total levels of strategic weaponry, the first reductions are going to come out of the fast flyer force. And the way further reductions, if some need to come out, as they probably would, of the bomber force, would be not by doing without a B-2, but by retiring older aircraft, shifting others into different roles, and leaving, in effect, probably the B-2 as the only penetrating bomber. That could be what we see in the next century.

But dropping the B-2 out means that you have given away the capabilities that that leg of the triad requires.

Senator WIRTH. Mr. Chairman, my time has expired. I think we are once again begging the question as to what the mission of the B-2 is. We will come back to that.

Thank you, Mr. Chairman.

Senator EXON. Thank you, Senator Wirth.

We are beginning the second round now.

This is just to follow up on this whole matter of START and the B-2.

General Chain has testified, you have testified, General Welch, and the Joints Chiefs are on the record that the reason the B-2 is so important in this whole matter is that with the counting rules that have been agreed to and the penetrating capabilities that we would have with the B-2, START, as envisioned, would be good for stability and good for the national security interests of the United States.

Now, if for any reason or a combination of reasons we do not have the B-2, certainly that goes a long way to change the equation upon which you and the other Joint Chiefs and General Chain supported START. Is that correct?

General WELCH. Well, I think that is absolutely correct. There is no attempt on anybody's part to blackmail START with the B-2. But the fact is that without the B-2, the START force presents us with significantly more risk than with the B-2. And we would be very uncomfortable with that risk.

Senator EXON. Or to carry that just one step further, if we did not have the B-2, at a minimum I would suggest that it would be your feeling at least, and you can speak for yourself, General, that we would have to go back and make some changes in START from the way it was originally envisioned and promoted?

General WELCH. Well, there would certainly have to be a new assessment. And the bomber counting rule, which was agreed to at Reykjavik, has always been a very, very important element in the overall assessment of the sufficiency of the force that we would be left with after START I. That is correct.

Senator EXON. Gentlemen, there have been many questions asked with regard to the reason and rationale behind the reduction from 132 B-2s to 75. Let me phrase a question to you in this way, and maybe we can begin to get this issue resolved. When Mr. Cheney briefed the committee on the results of the Major Aircraft Review, he characterized the reduction in the B-2 program from 132 aircraft to 75 aircraft as being based on the reduction in the number of targets to be covered in Eastern Europe.

Now assuming that these numbers translate into, say, 120 versus 60 B-2s, a reduction of 60 B-2s would reduce overall bomber-delivered weapons by almost 1,000, assuming of course that there are 16 weapons on each B-2 bomber. It seems to me that were there—the question then comes, were there 1,000 strategic targets for the B-2 in Eastern Europe before the collapse of Eastern Europe?

In fact, were not most of the Eastern European targets already assigned to our theater forces under the control of SACEUR, including several hundred SLBMs allocated for his use?

In sum, I would like to ask you what role did strategic bombers play in the targeting of Eastern Europe? I suspect not a significant role. Is that right?

General **Welch**. We are probably getting beyond what we can talk about very intelligently in an open hearing. Let me just say a couple of things.

As I indicated earlier, there are two key factors that entered into our operational thinking regarding the number of B-2s. One was the overall change in the situation brought about by what happened in Eastern Europe. There were significant targets in the SIOP in Eastern Europe, and not necessarily covered by that particular weapon, but nonetheless, there were significant targets in the overall equation. And so that is a factor.

It is also a factor, the overall reduction in the probability of something happening in Europe that could lead to the escalation that we have always been so concerned about. But the other major factor in our reevaluation is that we departed from the earlier bomber study that had come up with the 230 penetrating bombers, and we looked instead very specifically at which targets really require the peculiar, unique capabilities of the B-2 for the most efficient coverage.

And when we put all of those things together, then the Air Force came up with 75. And a number near that came out of the analytical work done by the JSTPS. So there is operational logic to the 75, not denying that the strong motivation for reexamining the 132 was because the Air Force had to take $117 billion out of our 1992 through 1997 program.

Senator **Exon**. Well, we have done these things in the past, General. If I remember correctly, were not we talking about 250 MXs at one time, and we ended up with 50?

General **Welch**. That is correct.

Senator **Exon**. In other words the B-2 reductions are driven by the budget. If the Air Force had the money I bet you would like to have 132 B-2s. You do not have it.

General **Welch**. Of course, it is a very versatile system and one that we would like to have that full number of. But as you say, it takes into account the fact that the world is changing, and it takes into account that the budget is changing. And it is a responsible position based on both considerations.

Secretary **Rice**. Mr. Chairman, if I could just add one thought that might be of some help to you. As I worked through, along with General Welch, all these factors that he has been describing for you, as well as our budget situation, it seems to me—or at least the way I tend to think of it, is that we were searching this time, in light of the changes in the world and the budget pressures and all the rest of it, we were searching for what is the minimum essential force. That is what we were trying to understand.

And we went through all of the kinds of operational factors that General Welch has been describing: the target side, what it takes to maintain a viable capability, how much does it take to seem to be significant in the deterrence equation, so that forces you to try to put on a Soviet hat and look at it. We have tracked through all the details of the SIOP execution and the target base that General Welch has been referring to.

All those things, together with the budget pressures, tended to drive us to the 75. And we saw that as what I can only describe as a minimum essential force. Given the budget pressures, if we thought a yet smaller number would really do the job we would have been willing to entertain that.

The budget pressures are still very severe, trying to keep everything together within the Air Force. And so we did not stop at 75 arbitrarily, we really tried to do it on operational grounds and on the basis of what is a minimum essential effective operating force for the long-term future that this system has got to perform in.

Senator EXON. Thank you. My time is up. Senator Cohen.

Senator COHEN. Mr. Chairman, I would like to clarify the issue of the bombers. I think Senator Wirth raised the issue of whether we were building bombers because they were building bombers, and of course that has never been the rationale. What I wanted to explore was General Welch's statement that both sides were accepting the fact that the bomber is a more desirable weapon because it is more stabilizing, being a second-strike system.

But, in fact, that is not what the Soviets have recognized, in my judgment. They recognize it is more secure for them that we have a B-2. And it is not a question of bomber against bomber. They recognize it is more stabilizing in the sense that it does not present a first-strike threat to them, as does an ICBM or an SLBM.

And the fact, I think, that Secretary Rice indicated, well, the one reason they do not have more bombers is they do not need them. We do not have any air defenses. And that is true, but that is not the rationale for why they do not have more bombers or want more bombers.

If they wanted to present a more stabilizing threat, let us say, to the United States, they would present more second-strike weapons. That would be easy for them to do. They could simply produce more Blackjacks, or possibly Backfires, and I assume that you would include the Backfire in a strategic category, as opposed to what the Soviets would like to categorize it, as a tactical type of weapon.

But they would present more Blackjacks than they would SS-24s or SS-25s or modified SS-18s. But they are not interested in presenting a more stabilizing force structure for a variety of reasons.

If we had more air defenses, the Soviets would be faced with a choice: They could either produce a stealthy penetrating bomber or they could rely more on ICBMs. But we do not have an air defense system other than our F-15s, perhaps, and a few other interceptors. And yet they continue to rely upon the ICBM primarily because it is cheaper for them and they have, notwithstanding all the money they spend, I assume they are faced with some financial constraints as well.

That was the only point I was trying to make. The Soviets may say that it is a more stabilizing system, but they are not moving in that direction as of this time. In fact, all of the indications are that they are not moving or accelerating their bomber production at all for a variety of reasons, some of them perhaps technical more than anything else.

I would like to at least ask General Welch this question. When we had a discussion about the B-2 at the last hearing, which I think was back in March—and I would say to Secretary Rice with all due respect because I do respect my friend—that the only thing with perhaps lower observability than the blue-winged locust or the honeybee worker and the B-2 bomber are the cost figures. They seem to have a low observability. We have been trying for three years to get some fix on that, and they have yet to show up on the radar.

Secretary **Rice**. Senator, we gave you quite a lot of detail on the 132-aircraft program, and all that was laid out with agreed estimates. There has been a major change made to the program, and one does not work out the new estimates that we are all prepared to stand behind overnight.

Senator **Cohen**. At the last hearing I believe General Chain was asked the question about the operation and maintenance figures for that 25-year period. General Welch, I think you were testifying as well. They have yet to be forthcoming. Maybe it takes a lot longer to develop them.

General **Welch**. We know what they are. I just do not have them in my hand.

Secretary **Rice**. Senator, for example, the basing plan affects the O&M costs, and with 75 aircraft we are going to have a different basing plan than we would have had with 132 aircraft.

Senator **Cohen**. I think you indicated in your opening statement there were changes made in the hangars and the basing plan, but that is something we would like to have.

The argument I wanted to at least focus on is something that I was confronted with following the last hearing. One of the network correspondents said they had just done an interview with someone over in the Pentagon, and the issue was raised that not only is a discussion of the B-2 one involving strategic or technical issues, but there was a moral issue involved as well; namely, that denying stealth technology to our Air Force personnel increased the risk to the pilots' lives and, therefore, there was a moral issue involved.

I was asked on camera, as a matter of fact, to respond to that kind of a moral issue, and I was struck by that. If it was the case that the moral issue was involved, then I suppose we have to be morally compelled to make all of our aircraft stealthy. You could not have fighter aircraft or interceptors or bombers. They would all have to be stealthy. I suppose if that were the case, we would have to make all of our ships either submarines or stealthy, because anyone who is serving on a surface ship certainly has increased risk to his life by being in a high profile.

I was wondering if that is an argument that has received much circulation in the Pentagon? I mean, I understand that the Department of the Air Force justifiably wants to present as many arguments in favor of the system as it conceivably can, but it was a new one to me. I had not heard that, and I was just wondering if someone was speculating from the network or was that something that has great credence within the Department?

Secretary **Rice**. Senator, you have just raised it for the first time in my hearing.

General **Welch**. I do applaud the thought that we worry about the pilot, but I have never raised that issue myself.

Senator **Cohen**. The other point with which I was intrigued and which I think Senator Glenn raised, the conventional use, one of the statements, which I think is on page 21, says we have always opted to use the best possible system to get the mission accomplished with the least possible risk to our crews, and cited as an example is the F-117 in Panama.

Again, if we are looking into the future now, it seems to me that if we are talking about the B-2 to be used on a regular basis in a conventional mode because we can anticipate that some of the third world countries will be acquiring sophisticated air defense systems—and the likelihood of the B-2 being used in a conventional mode would seem to be increasing—I have difficulty accepting the need or the justification for the use of the F-117 in Panama because they had air defense systems that might pose a risk to the crew.

That clearly was not the case there, was it?

General **Welch**. The use of the F-117 in Panama was simply because of its night capability.

Senator **Cohen**. The final point, if I may, Mr. Chairman, is to come back to the issue about the mission.

General Welch, you said it just about right when you said the principal mission is deterrence, that deterrence, once having failed, calls into question exactly, in my mind, at least, the viability of the weapons system itself.

It seems to me that what the B-2 presents is a potential threat to the Soviets. That is one thing as a deterrent. That deterrence having failed, it seems to me that the argument for its viability decreases rather dramatically. I cannot envision a situation in which the United States has been struck by a first strike preemptive shot from the Soviet Union or other future force with massive ICBMs and SLBMs and the United States at that point responding with its slow-flying B-2s or B-1Bs going through and penetrating a haze of nuclear debris and hurricane winds that might be unleashed in that kind of a scenario.

It seems to me that the use of the B-2 under those circumstances is rather dubious, that we would rely upon our ICBM force and our SLBM force to inflict massive and substantial damage. I think as a deterrent it is one thing, but the question is how much we are willing to pay for it, and the question is could you achieve something less of a deterrent capability with, say, the B-1B equipped with stealth cruise missiles? It would not be as strong a deterrent. I think we could probably argue that issue, but let us assume that it would not be as strong a deterrent. It would entail some greater risk as a deterrent. The question is, would it be worth the price?

Those are very abstract issues that I suppose we are going to have to come to grips with, but it is one in reality that is being driven by the budget in many respects.

General **Welch**. I really have to respond first by saying that I can think of nothing more damaging to the concept of deterrence than to raise doubts about whether or not we would use the system in retaliation. The whole basis of deterrence is for the deterred adversary to be convinced that you will indeed use those systems in retaliation should they be so insane as to unleash a strategic nuclear war.

Senator **Cohen**. I am not saying we would not use it, but you would have a much more effective response with your ICBM and SLBM force than you would with the B-2.

General **Welch**. Unfortunately, the ICBM and SLBM forces, of course, are constrained, as are the bomber forces. We fall into a curious mental attitude when we talk about what happens when deterrence fails.

In the first instance, in order to even discuss that we have had to contemplate the failure of something that is so basic to our survival that it is difficult to contemplate it, and that is that deterrence has failed, and we are now contemplating a massive exchange of nuclear weapons. Yet, having taken that step, we assume that everything else works right. We assume that, well, deterrence has failed, but you might not really need the bombers because surely all the submarines will work right and surely all the ICBMs will be launched on time and will arrive at their targets.

The fact is, the concept of the triad is to provide the assured capability in the minds of the Soviets that we will indeed be capable of mounting a devastating retaliation. You are discounting one leg of the triad.

Senator **Cohen**. You are making an assumption I did not make, and that is I asked you the question about whether or not a B-1B equipped with a stealthy cruise missile would present a slightly less credible deterrent but nonetheless a fairly substantial deterrent, would it not?

General **Welch**. My fear, as has been expressed before, is that if we give up the penetrating bomber, then we allow the Soviets to concentrate on cruise missile carriers. I believe that if allowed to concentrate all of those resources on cruise missile carriers instead of having to deal with the spectrum of bomber capabilities, than the Soviets can, as could we, find a very effective way to deal with cruise missile carriers.

So I do not believe you can give up the manned penetrating bomber and make the assumption that you then retain over the long term a viable force of cruise missile carriers. Now I am not talking about what would happen in 5 years or possibly even 10 years. We are looking at a longer horizon than that.

Senator **Cohen**. Thank you.

Senator **Exon**. Thank you, Senator Cohen. Senator Wirth.

Senator **Wirth**. Thank you very much, Mr. Chairman.

One of the arguments that is made quite consistently is that the B-2 will force the Soviets to spend a great deal of money to counteract the B-2, and that is the purpose of this chart here, I think, is it not, the one that has $61 billion down here very heavily and $400 billion up here?

Secretary **Rice**. No, sir. That is a reference to as much the investment they have made and their continuing expenditures together. It is not simply that we will force them to spend that much to counter it but that the B-2 negates an investment of that magnitude that the Soviets have made and are making.

Senator **Wirth**. So we are no longer making the argument that we are going to force the Soviets to spend a great deal of money in air defense to counter the B-2? That is no longer part of the rationale for the B-2?

General **Welch**. I do not think they will.

Secretary **Rice**. Over and above what they are doing anyway.

Senator **Wirth**. In the House of Representatives, I think that there are currently almost 200 people who have co-sponsored the legislation to kill the B-2. It looks to me as if they are at least moving pretty rapidly toward terminating the program. Do you have now some analysis as to what the termination costs of the B-2 would be, again getting a picture of how much the money is?

A year ago, we were talking about $1 billion. Now recently it is about $4 to $5 billion for terminating. Someone suggested maybe the B-2 is too expensive to terminate, too costly to terminate.

Secretary **Rice**. This specific legislation which I believe exists in both houses of Congress, though our count would be smaller than the number you just suggested, nonetheless the numbers to which you refer that the Members have indicated support for would complete the RDT&E program and complete this construction of the RDT&E-funded aircraft and the ten production funded aircraft. That program included termination costs. We estimate to require a total of $35.4 billion, of which $26.4, I believe, is already appropriated by the Congress.

One can do that arithmetic, even assuming it were possible, and I think there are very considerable open questions about it to have any viable operating capability at all out of those 15 aircraft, given the tremendous costs of support establishment and so on that would still have to be borne even to keep a very small number of the aircraft operational. You can divide $35.4 by 15 as well as I can and understand what we have paid at that point.

The incremental costs to go on from there and produce a real operational and military capability with all the characteristics and values we have been talking about here this morning is another $27 billion.

That buys the full-up 75-aircraft force.

Senator **Wirth**. So the difference between 15 and 75 is $27 billion?

Secretary **Rice**. Yes, sir.

Senator **Wirth**. So if we were to say we were going to stop now, that would get us 15, and we would have spent $36 billion; is that correct?

Secretary **Rice**. It would get, in our view, no effective military capability. It might deliver 15 air frames.

Senator **Wirth**. So for another 27 you get an additional 60, and that is the argument you are making?

Secretary **Rice**. That is correct.

Senator **Wirth**. Let me ask you a final question if I might, Mr. Secretary. You talked about the minimum essential force. When you talk about the minimum essential force, is that a function of the SIOP? Is that where you get the minimal essential force?

Secretary **Rice**. As I tried to say earlier, Senator Wirth, it is a function of several factors being taken into account and trying to integrate them together and see, as General Welch put it before, where the knee of the curve seems to be. One factor has to do with the SIOP and the identification of crucial targets that really do require the special capabilities of the penetrating bomber and particularly the B-2.

Another factor has to do with an estimate, a judgment if you will, about what it takes to be a viable element, a compelling element of the deterrence equation in future strategic balances. When I think about that one, I also try to take into account a best we can see it through a cloudy crystal ball today looking forward to what might happen under START II when, as we have suggested and as the agreed statements from the summit suggest, the emphasis is going to be on trying to further reduce the concentration of warheads on ballistic missiles. That will be the main focus there.

So we have to think about the elements of the deterrence equation. We try to recognize the fact that the penetrating bomber is critical to a long term, stable strategic balance. We look at the question of supportability and the economics of owning a bomber force. We just went through a part of it. We just went through the economics of acquiring a bomber force and understand what is really at stake and what kind of commitments have to be made, what sort of logistic support capabilities are required for any significant new system, including this one.

So we have tried to take, if you will, the economics of the situation, the operational viability of a force, the missions to be carried out, both nuclear and conventional, and put all that together and understand how far down can we come in light of these budget pressures and still have a satisfactory level of mission capability of this essential kind. That is how we got there.

Senator WIRTH. That is very helpful, Mr. Secretary.

As a final note, former Secretary Brown suggested that the minimal essential force could be 3,000 warheads, and General Chain said that reductions of that magnitude would be unacceptable.

What is your sense? Is General Chain's position the Air Force's position or the Pentagon's position?

Secretary RICE. Senator, I do not know the context in which either one of those comments were made, so I just have to try to respond to it this way.

We have certainly thought about numbers as low as 3,000 as possible objectives for a follow-on round of START. Now that 3,000 or 4,000 are the kind of numbers that are often talked about, and those, of course, would be presumably numbers that would be comparable to the 6,000 under START I. So counting rules would come into play in actually working out that number and so on, just as they do, whether or not they are the same rules.

One looks forward, then, looking into a necessarily cloudy crystal ball, at what kind of forces might make up such a significantly reduced strategic force balance, at least on our side, having tried to work through the same thing on the Soviet side. We would expect to see significantly reduced reliance on ICBMs in that model and, inevitably, I think some reductions in the other two legs as well but relatively reduced reliance, dependence probably, on ICBMs. Just how those reductions in the other two legs would be taken is something to which obviously there is no specific answer, but we would still see it as a reduced scale mix of penetrating and standoff elements in the air breathing leg.

Now one could get there. If you are going to keep the penetrating component, as we think is necessary to do, then you have to have the B–2. And you can get to a reduced force structure by recognizing that we are going to have B-52s getting awfully old out in the next century anyway, and perhaps in the next century it might make sense to transition the B–1 to a cruise missile carrier.

So those kind of options are all out there for us to pick up on in plenty of lead time to implement them in accord with follow-on strategic arms reduction agreements should we be able to make them.

Senator WIRTH. Mr. Secretary and General Welch, thank you very much. We appreciate your being here this morning.

Thank you, Mr. Chairman.

Senator EXON. Thank you, Senator Wirth.

Gentlemen, thank you so much. We have had a long, very interesting session. There will be some additional questions for the record to which we would like you to respond as quickly as you can.

Thank you for being here, Mr. Secretary.

Thank you again, General. One last time, I suppose, before the committee, I want to salute you for your service to the Air Force and your service to the Nation as a whole. We wish you the best.

General WELCH. Thank you.

Senator EXON. With that, we are adjourned.

[Questions for the record with answers supplied follow:]

QUESTIONS SUBMITTED BY SENATOR J. JAMES EXON

TESTING

Senator EXON. Have any of our stealth platforms—the F–117A, the Advanced Cruise Missile or the B–2—been systematically tested against shipboard defenses, ranging from single vessels to a carrier battle group? Would the Air Force support further testing, both cued and uncued, to determine more precisely what U.S. stealthy platforms could accomplish in support of sea control and how well U.S. at-sea defenses would work against stealthy attackers?

Dr. RICE and General WELCH. Limited engineering tests have been performed to gain a better understanding of shipboard defense radar operations against stealthy platforms. The conditions of the tests were strictly controlled in that they were performed on operational radars. Neither the stealthy platform nor the shipboard defenses were utilized in a true operational fashion. This allowed both the shipboard defense developer and the stealthy platform designer to gain a better understanding of the impacts of each on the other. Further testing would certainly add to the body of knowledge of stealth's impact on shipboard defenses.

B–2

Senator EXON. Could you describe where the Air Force is in the flight test program, in terms of planned versus actual accomplishments, and describe what remains to be done in order to release the fiscal year 1990 productions funds?

Dr. RICE and General WELCH. The performance to date in flight test has been better than expected. Since the first flight on July 17, 1989, the B–2 has accumulated 67.1 hours in 16 flights. The B–2's aerodynamic performance has been close to the predictions and all its pilots have remarked on its excellent flying qualities.

Three congressional requirements restrict the release of fiscal year 1990 production funds. The first is completion of Block I (basic flying qualities) testing. Block 1 flight testing was completed on June 11, 1990, and all that remains is SecDef certification that there are no major aerodynamic problems. The second requirement is the start of Block 2 (low observable) flight testing. Low observable tests are scheduled to begin in the fall of 1990, following completion of a scheduled layup with Air Vehicle 1. The last requirement is the report on cost, schedule, and capability. This report is currently in coordination.

FIXED PRICE OPTIONS

Senator **Exon**. The Air Force has had in effect a fixed price contract with a series of annual procurement options for a collection of some 31 items. For the past 2 years, the Air Force has had to purchase several more "kits" of these items in order to meet the minimum order quantity for each year, thus preserving the option to continue the fixed pricing. The Air Force has always argued that the fixed pricing originally negotiated on these "kits" was very advantageous to the Government, and (b) that the number of "kits" excess to production aircraft was small and would disappear by 1992 or so. With Mr. Cheney's program revisions, especially with the lowered annual production rate, are these fixed price options still advantageous, or should we let the options lapse in fiscal year 1991?

Dr. **Rice** and General **Welch**. Even with a 75 aircraft program, protecting the fixed price options is still advantageous to the Government. The fixed price options capitalize on aircraft subsystem prices negotiated against a larger aircraft procurement base (127 production aircraft), producing economies of scale not possible with the MAR profile.

Questions Submitted by Senator Strom Thurmond

Senator **Thurmond**. Can you translate these numbers about radar detection ranges into survivability? If a B-1B and a B-2 flew over the same Soviet air defenses, what is the comparative survivability?

General **Welch**. We recently conducted an analysis of B-1B and B-2 survivability against future Soviet air defense systems. We learned that the B-2 is greater than two times more survivable than the B-1B. A similar study done by the Institute for Defense Analyses, and independent research organization tasked by Congress, arrived at comparable results.

Senator **Thurmond**. Would you be willing to fly the B-2 against the Aegis radar in a realistic test? Do you think this would be an effective test of the plane's capabilities?

General **Welch**. The Air Force B-2 test plan does not include testing against the Aegis system at this time. Any operational assessment of the results of such a test would have to take into consideration the mission requirements of both systems. The B-2's mission is to attack a large number of targets spread across vast geographic areas, utilizing low observability, variable routing, high and low altitude penetration tactics, and terrain masking. Aegis, on the other hand, is part of a layered defensive system optimized toward point defense of an isolated target, utilizing unobstructed lines of sight against attackers on more predictable axes of attack. In sum, we would be testing both systems in a manner for which they were not designed.

DEFENSE SUPRESSION BY NUCLEAR WEAPONS

Senator **Thurmond**. Do I understand correctly that the B-1B will always need to have Soviet defenses knocked out by prior nuclear missile shots, but that the B-2 can penetrate without the need of all these precursor nuclear weapons?

Dr. **Rice**. No, you do not understand correctly. Both the B-1B and the B-2 possess inherent survivability, but survivability is increased with prior defense suppression. Mission planning for these aircraft exploits their unique attributes. B-1B missions make use of its speed and active defense systems, while B-2 missions will capitalize on its stealth capabilities.

[Whereupon, at 11:42 a.m., the hearing was adjourned.]

DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEAR 1991

WEDNESDAY, JUNE 20, 1990

U.S. SENATE,
SUBCOMMITTEE ON STRATEGIC FORCES
AND NUCLEAR DETERRENCE,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

STRATEGIC DEFENSE INITIATIVE

The subcommittee met, pursuant to notice, at 2:04 p.m., in room SH-216, Hart Senate Office Building, Senator J. James Exon (chairman of the subcommittee) presiding.

Committee members present: Senators Exon, Levin, Bingaman, Glenn, Gore, Wirth, Shelby, Warner, Thurmond, Wilson, and Wallop.

Professional staff members present: Robert G. Bell, William E. Hoehn, Jr., and William H. Smith.

Minority staff members present: Brian D. Dailey, George W. Lauffer, and John E. Mansfield, professional staff members.

Staff assistants present: Elizabeth Harlow, Mary J. Kampo, Melissa Ann Ramsey, and Mickie Jan Wise.

Committee members' assistants present: Andrew W. Johnson, assistant to Senator Exon; Kenneth N. Luongo, assistant tc Senator Levin; Edward M. McGaffigan, Jr., and John Gerhart, assistants to Senator Bingaman; Donald A. Mitchell, assistant to Senator Glenn; Leon S. Fuerth, assistant to Senator Gore; Terence M. Lynch, assistant to Senator Shelby; Melvin G. Dubee, assistant to Senator Byrd; James M. Bodner, assistant to Senator Cohen; Patrick F. McCartan, assistant to Senator Wilson; Thomas G. Moore, assistant to Senator Wallop; Robert M. Soofer, assistant to Senator Gorton; Charles G. Pearcy, assistant to Senator Lott; and Eric H. Thoemmes, assistant to Senator Coats.

OPENING STATEMENT OF SENATOR J. JAMES EXON, CHAIRMAN

Senator EXON. The subcommittee will please come to order.

The subcommittee meets today in open session to review the fiscal year 1991 budget request for the Strategic Defense Initiative, and to review compliance with our treaty obligations for all of the planned SDIO tests that will be carried out utilizing any of the funds to be authorized and appropriated for fiscal year 1991.

In the last year or so we have seen many remarkable changes in the world, including the collapse of communism throughout Eastern Europe, and a substantial thaw in the Cold War, or perhaps I should call it a strategic global warming.

The United States and the Soviet Union are on the verge of completing both a START Treaty and a conventional forces Europe treaty. And the President has declared our intention to work with the Soviets to replace containment with, in his own words, and I quote, "an era of enduring cooperation."

Against this background of reduced tensions and growing cooperation, the SDI program as currently structured seems to stick out like a sore thumb. While the Soviet Union has dropped its demand for a formal linkage between the START agreement and deployment of the SDI, they have repeatedly made clear that a U.S. decision to deploy any SDI system not in compliance with the traditional interpretation of the ABM Treaty would constitute grounds for them, under the Supreme National Interest Provision therein, to abrogate the START Treaty.

Yet, the administration proposes to spend nearly $60 billion in the upcoming 6-year plan, which would, if Congress agreed, within a few years require testing beyond that which can be accommodated under the traditional interpretation of the ABM Treaty, and at the end of the period, initiate deployments that would violate the treaty under either interpretation.

The SDI sticks out like a sore thumb on budgetary grounds, also. The SDI request for fiscal year 1991 is $4.66 billion, consisting of $4.47 billion for the Department of Defense, and another $190 million for the Department of Energy. Over the last 5 years, the Congress has given the SDIO an average of $3.3 billion per year. In a year when overall defense spending will be decidedly lower, the DOD funding request for the SDI represents an increase of 25 percent over the amount authorized and appropriated for the current fiscal year.

But that is only the tip of the iceberg. First, the Six-Year Defense Plan for the SDI of $58 billion amounts to an average for SDI of nearly $10 billion per year for the next 6 years. That is triple the amount the Congress historically has been willing to authorize and appropriate for SDI, even before, before, I emphasize, we factor in the implications of the end of the Cold War.

Second, the estimates prepared by the GAO for the Congress indicate that the cost to go for SDIO to reach the deployment of the proposed Phase I strategic defense is well over $100 billion.

Does anyone believe that the Congress is going to fund a $100 billion-plus SDI program?

Thus, I believe today's hearing needs to focus as much on the long-term plans and funding requirements for the SDI as on the details of how the SDIO would spend the requested fiscal year 1991 funds of $4.6 billion.

I believe we have an excellent set of witnesses with whom to explore these issues. Let me first welcome the Honorable Charles Herzfeld, the Director of Defense Research and Engineering. Dr. Herzfeld will be representing and speaking authoritatively for the Under Secretary of Defense, Mr. John Betti, who is the defense official responsible for ensuring the compliance of SDIO with all treaty obligations.

Welcome, Dr. Herzfeld. We will have some significant questions about compliance as we move forward with the hearing.

We are also pleased to welcome the Honorable Stephen Hadley, who is the Assistant Secretary of Defense for International Security Policy.

Also, welcome to you, Dr. Hadley.

Our third witness is Lt. Gen. George Monahan, Jr., the Director of the Strategic Defense Initiative Organization, and a frequent witness before this committee.

I should call to the attention of the committee that this is likely to be General Monahan's last appearance before us. After a distinguished 35-year career in the Air Force, General Monahan will shortly be retiring.

Speaking for myself, I have only the highest praise for General Monahan and the excellent job that he has done. He has had a difficult job as the Director of SDIO for the past several years, which he performed with diligence. He has enjoyed the confidence of this committee in all aspects of the Strategic Defense Initiative.

General Monahan, we welcome you once again, as we have before. And we thank you for your years of most distinguished service to this country.

We will hear from our witnesses in just a few minutes, but first, let me invite my great friend and colleague, the ranking minority member of the subcommittee, Senator Strom Thurmond of South Carolina, to offer any opening remarks that he has. Senator Thurmond.

Senator THURMOND. Thank you very much, Mr. Chairman.

Mr. Chairman, I welcome the witnesses to the subcommittee to give testimony on the Strategic Defense Initiative.

Mr. Hadley and Dr. Herzfeld, it is always a pleasure to have you testify before this subcommittee.

I also want to take this opportunity to say a few words about General Monahan, who will retire from the Air Force tomorrow, after 35 years. This is the last time General Monahan will testify before this subcommittee as an active duty military officer. His military career has been distinguished, and a credit to the men and women of our Air Force.

During his tenure as Director of the Strategic Defense Initiative Organization, General Monahan has been an outstanding leader. Most importantly, he has earned the respect of this committee during his nearly 2 years as SDIO director, a fact which I attribute to the high degree of credibility he has with its members.

General Monahan has served the country well. Through his tireless efforts, the Nation has made great strides to develop the technology necessary to build effective defenses for the protection of this Nation from the threat of ballistic missiles and nuclear weapons.

Thank you, General Monahan. And I hope you will once again serve your country in a civilian capacity.

Finally, I want to make a comment on the suggestion by some that the need and usefulness of SDI is obviated by historic world events of the past year. I do not share this view. The uncertainty and instabilities resulting from these changes in the world suggest that the requirements for missile defenses is more, not less, important.

Combined with the proliferation of advanced technology of Third World countries, and the relentless modernization of Soviet strategic forces, the United States and our allies must reexamine the role and contribution that such defenses can make in maintaining deterrence and enhancing stability in the world. For this reason, I support strongly the President's view that missile defenses are just as important now, if not more so, than they were just 1 year ago.

Thank you, Mr. Chairman. And I look forward to the testimony.

Senator EXON. Thank you very much, Senator Thurmond.

We will now proceed with the prepared remarks of the distinguished members of the panel.

Without objection, we will accept the written statements from the witnesses into the record at this time. And we would appreciate very much if each one of you would briefly summarize in your own words the statements that you have made which we have accepted as part of the record.

Dr. Herzfeld, we will start with you.

STATEMENT OF CHARLES M. HERZFELD, DIRECTOR, DEFENSE RESEARCH AND ENGINEERING

Dr. HERZFELD. Thank you very much, Mr. Chairman.

It is a great pleasure and an honor to be here again before this committee. I thank you for the opportunity to testify on these matters.

I want to thank you for the very kind introduction that you gave me, and I would like to add also my words of appreciation to George Monahan, whom I have known since he took over the SDIO program. The few months that we have served together have been a pleasure because of his highly professional management of SDIO. I want to go on record as thanking him for having done a great job and having made my life much easier than it might have been.

My task today, I believe, is to discuss the processes that ensure that all DOD acquisition activities are fully compliant with the ABM Treaty obligations of the United States. I believe, then, Secretary Hadley will discuss some general policy related to SDIO, and then finally, General Monahan will give his perspective of these matters.

When I accepted my job I knew that it was a great management challenge of helping Under Secretary Betti make the acquisition process more efficient and more responsive. But I also realized that it was important to establish a defense technology strategy, which as I have indicated at my confirmation hearings and other hearings, we are well underway with that.

Another dimension which I was made quite clearly aware of during the confirmation process was my responsibility for keeping acquisition programs compliant with arms control treaty obligations, and I think that we have managed to do that.

By proper planning, we hope to improve the acquisition system, but we will continue to ensure that it remain compliant to our treaty obligations.

Part of the process that makes our programs compliant is a group which is chaired by Mr. Lee Minichiello and has participation from the DOD General Counsel, members from the Under Secretary of Defense for Policy, the Chairman of the JCS, defense agencies, SDIO, and the military services, as well as USD(A) instruction and guidance related to these matters.

We have the management and we believe it works well.

We review and evaluate quarterly, compliance reports by each of the service Secretaries, and we certify experiments specifically for SDIO for treaty compliance before the experiments are undertaken. This is spelled out in more detail in the statement I submitted for the record, and does not need to be repeated here.

What I want to emphasize is that it is an integrated look at each question that takes on the relevant expertise in the Department into the process, and it is thorough. Some say it is sometimes slow. That is also true sometimes. But you cannot have thoroughness at breakneck speed, and we try to avoid that. I think over the years the compliance review group has constructed the framework and a tradition of open-minded, careful deliberation that yields solid results.

In fiscal years 1990 and 1991, a certain number of SDIO programs were certified for compliance. They are listed in the Secretary's report to the Congress on SDI. They are also briefly mentioned in my statement. Unless you wish for me to review it here, I will just refer to that. I do not think that is really at the center of our concern this afternoon.

The result of the compliance process which I have mentioned, and which is explained in more detail in the statement, I am convinced that Secretary Cheney, Under Secretary Betti, and I, can confidently state to you that the SDIO's research program is being conducted in a manner that is fully compliant with all U.S. international obligations, including the ABM Treaty. We are proposing no experiments or tests in fiscal year 1991 that would go beyond what some call the restrictive interpretation of the ABM Treaty. Nor does our program include funds to purchase equipment in fiscal year 1991 that would be uniquely required for such experiments or tests.

Should our plans in this regard change, and we must always leave that as a possibility, we would consult with the Congress, and we would request your approval through normal budgetary procedures which have been established.

Mr. Chairman, this concludes my statement. I would like to suggest that we go on to the other statements, and after that I would be open for any questions you may have.

[The prepared statement of Dr. Herzfeld follows:]

STATEMENT OF THE HONORABLE CHARLES M. HERZFELD DIRECTOR, DEFENSE RESEARCH AND ENGINEERING

Mr. Chairman, thank you for the opportunity to testify before the Subcommittee on Strategic Forces and Nuclear Deterrence. Today I will discuss the process which ensures that all DoD acquisition activities are fully compliant with our ABM Treaty obligations. Accompanying me today are the Honorable Stephen J. Hadley, the Assistant Secretary of Defense for International Security Policy, and Lt. Gen. George L. Monahan, Jr., Director of the Strategic Defense Initiative Organization.

When I accepted my post, I knew that I was accepting a great management challenge--that of helping Under Secretary Betti to make the defense acquisition process more efficient, more streamlined, and more responsive. This requires understanding the differences between those constraints on the process that can and should be changed and those that cannot be changed. As part of the process of cultural change, we are engaged in a number of initiatives to improve the process that was laid out in the architecture of the Defense Management Review by the Secretary last year. At the same time, we must comply with existing laws, including assuring that the defense acquisition programs remains compliant with limitations associated with arms control agreements. That job requires supervision of an existing process to review and evaluate our defense acquisition programs so we can certify compliance with our treaty obligations. In responding to such management challenges, I believe that we must demonstrate the ability to meet our commitments and develop confidence and trust that we are not only doing things right, but doing the right things. By proper planning, we hope to improve the acquisition system to ensure that it functions efficiently, effectively, and lawfully in a rapidly changing budgetary, political, and arms control environment.

In general, we have developed what I believe to be an excellent process to ensure continuing compliance with the ABM Treaty, the INF Treaty, and other treaty obligations that could impact our acquisition programs. As part of this process, in coordination with the DoD General Counsel, the Under Secretary of Defense (Policy), the Chairman of the Joint Chiefs of Staff, the defense agencies, the SDIO, and the military services, the USD(A) issues instruction and guidance to the military services and defense agencies to help structure their R&D, field-testing, and acquisition programs so that they are compliant.

We establish the necessary management process and procedures for evaluating compliance, and render on a case-by-case basis decisions which certify programs that are compliant with our treaty obligations. We also review and evaluate quarterly compliance reports by each military service Secretary and defense agency director and certify their internal compliance programs.

Questions which arise within the department regarding the compliance of acquisition programs with specific agreements are referred to the USD(A) office for resolution on a case-by-case basis. Any system that raises a compliance issue will not be tested or deployed without prior clearance. Before rendering a decision, we receive the advice of the DoD General Counsel, the Under Secretary of Defense (Policy), and the Chairman of the Joint Chiefs of Staff or their staffs. Let me reassure you that I fully understand the obligation and responsibility to ensure that our DoD acquisition programs are compliant with the ABM Treaty and other treaty obligations.

To assist in evaluating research & development, testing, acquisition, and deployment programs, a DoD Compliance Review Group chaired by Mr. Lee Minichiello, the Director, Strategy, Arms Control, and Compliance, who has accompanied me here today, provides technical analysis and staff review of experiments and programs that raise compliance questions. In addition to the chairman from acquisition, the Compliance Review Group is composed of representatives from the offices of the General Counsel, International Security Policy, and the Joint Staff. The review group functions as the central body within the Department of Defense responsible for directing and reviewing technical analysis to ensure compliance with our treaty obligations.

For example, the first step in evaluating a Strategic Defense Initiative experiment occurs when the SDIO contemplates an experiment which may require technical analysis to assure its compliance. Once identified, the program manager briefs the Compliance Review Group on the purposes and objectives of the experiment, how the experiment is structured, and on important programmatic timeframes and deadlines.

Members of the Compliance Review Group then discuss with the program manager the relevant compliance aspects of the prospective experiment; any pertinent guidance and instructions dealing with the experiment; any previous Compliance Review Group analysis that could have a bearing on the experiment being compliant; and, if appropriate, clarifications regarding ABM Treaty language.

At this juncture, the Compliance Review Group constructs a framework for any technical analysis necessary to help clarify and ultimately resolve compliance questions, should any arise. The Compliance Review Group may require further analysis before assessing compliance; or it may direct an independent technical analysis of the experiment.

FY 90 and 91 SDIO programs certified for compliance are listed in the Appendix to the Secretary of Defense's Report to Congress on the Strategic Defense Initiative entitled "SDI Compliance with the ABM Treaty." The experiments are: the Delta Star Experiment (on orbit; launched February 1989); the Laser Atmospheric Compensation Experiment (LACE) and Relay Mirror Experiment (RME), on orbit; the Kinetic Kill Vehicle Integrated Technology Experiment (KITE) flights in the High Endoatmospheric Defense Interceptor (HEDI) program; the Airborne Surveillance Testbed (AST); the Starlab tracking and pointing experiments; the Ground-Based Interceptor (GBI), formerly the Exoatmospheric Reentry Vehicle Interceptor Subsystem (ERIS) flight experiments; the Arrow antitactical missile flight experiments; the Lightweight ExoAtmospheric Projectile (LEAP) flight experiments; and a series of tests associated with the Brilliant Pebbles concept.

In addition, the Boost Surveillance and Tracking System (BSTS) has been reviewed and guidance issued for the construction and deployment of Treaty compliant satellites for the Tactical Warning/Attack Assessment mission; to be launched beginning in the mid-1990s.

As a result of the compliance process which I have explained, Secretary Cheney, Under Secretary Betti, and I can confidently state that the SDIO's research program is being conducted in a manner fully compliant with all U.S. international obligations, including the ABM Treaty.

As a matter of fact, the SDI program we are proposing includes no experiments or tests in FY 91 that would go beyond what some call the restrictive interpretation of the ABM Treaty; nor does our program include funds to purchase equipment in FY 91 that would be uniquely required for such experiments or tests. Should our plans in this regard change, we would consult with the Congress and request your approval through normal budgetary procedures.

Mr. Chairman, this concludes my statement. I would be pleased to respond to your questions.

Senator EXON. Thank you very much, Dr. Herzfeld.

I believe you are next, Mr. Secretary.

STATEMENT OF STEPHEN J. HADLEY, ASSISTANT SECRETARY OF DEFENSE FOR INTERNATIONAL SECURITY POLICY

Mr. HADLEY. Thank you, Mr. Chairman.

I want to say how much I appreciate the opportunity to appear before the subcommittee today. And I would also like to add my words of praise and thanks to General Monahan for the wonderful job he has done.

Senator EXON. Mr. Secretary, would you pull the mike just a little closer. I think maybe the back of the room might have trouble hearing.

That is about right I think.

Mr. HADLEY. Thank you, Mr. Chairman.

I just wanted to thank you for the opportunity to appear before the subcommittee, and add my words of praise and thanks to the job General Monahan has done leading the SDI program in his years as its director.

Mr. Chairman, you asked the right question, I believe. It is a time of dramatic change in the international security environment. And the question really is, does SDI still make sense? And I think the President has answered that question in comments he made at the Lawrence Livermore Laboratory on February 7, 1990, when he said, as you noted, "it makes sense now more than ever before."

And the reason I think is that because SDI still offers an enormous potential to make a great contribution and perhaps an even greater contribution to deterrence.

First, let me talk with respect to a Soviet attack. SDI offers the prospect of complicating an attack, of heightening uncertainty, and therefore decreasing the likelihood of such an attack. It also addresses some concerns that we have had that really cannot be addressed in any other way, in terms of potential mobile systems which are increasing in the Soviet inventory. And it does it in a way that does not threaten the pre-launch survivability of those systems. So it does it in a way that is indeed stabilizing.

And finally, it offers the prospect of offering some protection to our own U.S. assets, U.S. forces in command, control and communication.

I think the other point that needs to be stressed is that SDI is not inconsistent with our arms control objectives or really with the new environment that is emerging in our relations with the Soviet Union.

The reductions in strategic forces and in the levels of strategic forces that we see under the emerging START agreement, allow defenses to accomplish their more stabilizing purposes with either a smaller deployment, or increase the effectiveness of any given level of deployment. They also provide a hedge against possible cheating by the Soviets against a START I agreement.

And perhaps more importantly, they support our objectives for START II, which are to eliminate the SS–18 force, and to eliminate MIRVed, silo-based ICBMs. SDI, in our view, offers enormous leverage to our negotiators to achieve these objectives in START II.

And finally, there is really an emerging area where we think SDI can offer a real contribution, and this is the potential for handling the problem of the proliferation of ballistic missiles that is occurring, and which has been alluded to in a number of public statements, including by the Director of Central Intelligence. The issue is not simply protection of the U.S. homeland against those threats; it indeed, initially, will be a question of protecting U.S. allies, U.S. deployed forces overseas, and power projection capabilities.

And I need not go into that in this committee about the details on the proliferation of these threats.

So one of the things we are doing is looking harder at what potential SDI offers for dealing with these emerging problems.

The last point, Mr. Chairman, I might make is simply that we are seeing some real progress in moving the Soviets to the acceptance of the possibility of a stabilizing role played by defenses. And I might mention in that connection, the statement that recently came out from the U.S./Soviet summit has some interesting language, the kind of language I think we would not have seen in a communique of this sort a few years ago.

The two parties in that communique agreed to pursue new talks on strategic offensive arms and on the relationship between strategic offensive and defensive arms. It talks about the objectives of those negotiations. It says that those objectives will be achieved by seeking agreements that improve survivability, remove incentives for a nuclear first strike, and implement an appropriate relationship between strategic defenses and defenses.

It talks about the need to continue, without delay, the existing negotiations in Geneva on defense in space. And to have future negotiations which would discuss, among other issues, the relationship between strategic offensive and defensive arms, taking into account not only the reductions on the offensive arms, but also the development of new technologies. And these technologies are defensive technologies.

And the point, I think, is that the Soviets in this statement really have agreed to an agenda which is our agenda, and an agenda which is way beyond the kind of language we have seen in the past about the purpose of defense in space talks to be avoiding an arms race in space or reaffirming commitment to the ABM Treaty.

In addition to this, Mr. Chairman, there is evidence that there is really an internal debate within the Soviet Union, at least beginning, questioning whether a greater emphasis on defenses is not perhaps more consistent with the new relationship between the United States and the Soviet Union, and whether they also do not provide a vehicle for dealing with these kind of third-country threats, which obviously threaten the Soviet Union as well as the United States.

So, in conclusion, Mr. Chairman, we think that there continues to be an important role for SDI and for defenses, even in this new world in which we are entering into, and that we are making some progress in convincing the Soviet Union that that is indeed the case.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Hadley follows:]

STATEMENT OF
STEPHEN J. HADLEY
ASSISTANT SECRETARY OF DEFENSE FOR INTERNATIONAL SECURITY POLICY

Mr. Chairman and Members of the Subcommittee,

It is a distinct honor for me to appear before you today to discuss the Administration's policy and strategy rationale for the SDI program, and our view that strategic defenses can make unique contributions to international security in the 1990's. I will also describe our efforts in the Defense and Space Talks in Geneva to encourage the Soviet Union to join us in a transition to a more stable and secure strategic relationship based on increased reliance on strategic defenses.

Twelve months ago, Under Secretary of Defense for Policy Paul Wolfowitz appeared before you to discuss the results of the Administration's review of U.S. national security strategy as it related to the SDI program. Ambassador Wolfowitz reported that President Bush had concluded that the goals of the SDI program remain sound; that we would aggressively pursue layered defenses, based on advanced technologies like Brilliant Pebbles, designed to strengthen deterrence and stability; that we would conduct the program in compliance with all U.S. international obligations; and that the program would be structured to support an informed decision on deployment not later than the summer of 1993.

At that time, no one could have anticipated the dramatic changes in the international security environment that were to follow. Soviet economic and political reforms have potentially profound implications for U.S.-Soviet relations. We appear to be seeing the dissolution of the Soviet empire in Eastern Europe, and in its place the promise of free and democratic countries. The Soviet Union has announced reductions in its defense expenditures, and the prospect of a successful CFE agreement will significantly reduce Soviet conventional military capabilities. As Members of this Committee have noted, under these circumstances, the Warsaw Pact's capability to launch a major attack on NATO with little warning would all but disappear. As the Soviets have concentrated more and more on their internal problems, and in developing new relationships with their former Eastern European satellites, the prospects for direct Soviet aggression against the United States and its interests have declined accordingly.

Strategic Defenses in a Changing World:

The improvements in U.S.-Soviet relations have lead many to question the need for many of our defense preparations, and specifically the need for the SDI program. I think President Bush addressed this best in his visit to Lawrence Livermore National Laboratory earlier this year, "In the 1990's, strategic defenses make much more sense than ever before." I would like to describe for you the reasons why the President and Secretary Cheney have reached this conclusion.

While we have seen reductions in Soviet defense expenditures in the area of conventional forces, the Soviet Union is continuing to pursue a robust strategic force modernization program. We are continuing to see deployment of the SS-18 Mod 5, the SS-24 and SS-25 mobile ICBMs, new SSBNs and their associated SLBMs, Bear H and Blackjack bombers, extensive strategic air defense deployments (such as the SA-10, SA-12), and modernization of the Moscow ABM system. We also continue to see the development of follow-on systems in many of these areas.

Despite the promise of a START agreement that will result in significant reductions in Soviet strategic ballistic missile warheads, the Soviets will retain a substantial strategic force under START. As a result of ongoing modernization programs, this force will be of higher technical quality than their current force. As Lieutenant General Soyster, the Director of the Defense Intelligence Agency stated in January, "Even after INF and expected START treaty reductions, the Soviets will likely be able to satisfy their critical nuclear targeting requirements as with their current arsenal due to ongoing force modernization." Hence, despite what appear to be changing Soviet intentions, the requirement to deter Soviet strategic force capabilities will remain. SDI is a key element in our deterrent strategy.

Strategic defenses also have an important role to play under START reductions, and there is a synergism between strategic defenses and offensive force reductions. Reduced offensive forces -- not only warheads, but perhaps more importantly reductions in throw-weight -- make the job of the defense easier, and thus START may enable us to develop a more modest and less costly strategic defense system. Reduced throw-weight limits the Soviet capability to carry decoys and other counter-measures.

Deployed strategic defenses under START would also provide insurance against possible Soviet cheating, which becomes more militarily significant under reduced overall force levels, and protect against possible verification limitations. Strategic defenses may also be the most effective means of addressing the growing threat posed by Soviet mobile missiles -- without threatening the pre-launch survivability of these systems. Strategic defenses would also enhance the survivability of remaining U.S. strategic forces and associated command, control and communications -- which will be of even greater importance with reduced overall force levels -- and NATO's air bases, where the bulk of NATO's theater nuclear forces will reside due to the cancellation of the follow-on to Lance and nuclear artillery modernization.

Additionally, strategic defenses could provide a foundation for even further, stabilizing offensive force reductions. In particular, because they are most effective against MIRV'ed missiles, space-based defenses provide an incentive for the Soviets to de-MIRV their ballistic missile forces -- thus complementing an important objective of U.S. arms reduction policy. The SDI program, together with other elements of our strategic modernization program and U.S. arms control policies, is intended to strengthen deterrence. These complementary means of strengthening deterrence are fully integrated and mutually reinforcing.

Emerging Threats:

While the overall Soviet threat may be diminishing, there are other emerging threats that directly affect U.S. security interests. Specifically, I am referring to the growing proliferation of ballistic missiles armed with conventional, chemical, biological or even nuclear warheads. According to the Director of Central Intelligence, some 15 developing nations are expected to have ballistic missile capabilities by the year 2000. Many of these systems will have ranges of several thousand kilometers, and some may be of intercontinental range. When viewed in the context of emerging space surveillance capabilities, these ballistic missile systems pose a serious threat. In the hands of hostile countries these systems could pose a direct threat to U.S. forces deployed overseas, our friends and allies, and U.S. power projection capabilities. It is only a matter of time before the United States itself is directly threatened by these systems.

As a result of reductions in U.S. defense spending and reduced access to overseas bases, the forward deployment of U.S. forces will decline. However, the U.S. role as a superpower with vital interests worldwide will not decline. To defend these interests the United States will have to be able to project power, and this will involve the use of forces that are deployed in the continental U.S. during peacetime. In projecting power, we are likely to be operating within range of these threats. Ballistic missile capabilities in the hands of hostile powers could thus unacceptably limit the President's flexibility in pursuing vital U.S. interests, and undermine U.S. credibility as a distant security partner.

This is not simply a theoretical threat. As you will recall, in 1986 Libya launched two SCUD missiles at a U.S. facility in the Mediterranean. Fortunately, these missiles fell short of their intended target. More recently, Iraqi President Saddam Hussein threatened to use missiles armed with chemical warheads against Israel. When we look at the use of ballistic missiles in the Iran-Iraq War and in Afghanistan, we are reluctantly forced to conclude that whatever taboo that may have existed against using these systems no longer exists.

The U.S. has attempted to constrain the proliferation of ballistic missiles through non-proliferation efforts, embodied in the Missile Technology Control Regime (MTCR), and other diplomatic means. These efforts remain vital, but experience indicates that they are by themselves inadequate. Since it is by no means clear that these threats can be "deterred," active defenses will likely need to be an element of any truly effective means of addressing this threat. This raises an interesting question: Would it not be far preferable to have countries respond to what they viewed as serious threats to their security by engaging in ballistic missile defense activities rather than by developing their own offensive missile capabilities?

A combination of space-based defenses, with their global coverage, and terrestrially-based defenses could provide an active means of countering these threats. Thus, strategic defenses could be vital in preserving the President's future flexibility in defending U.S. interests in the emerging international security environment. As a result of our review of this emerging environment, we are taking a close look at the theater defense programs we have underway, including the Israeli ARROW program, with a view toward increasing the priority assigned to this important area.

Strategic Defenses and U.S.-Soviet Relations:

I have discussed ways that strategic defenses can address some of the threats to U.S. national security we foresee in the future. I would also like to discuss how we hope to use strategic defenses as a means of bringing about positive and lasting change to the international security environment -- particularly in the U.S.-Soviet relationship.

In recent Soviet declaratory statements, there has been considerable emphasis on defensive doctrine and forces. Yet the U.S.-Soviet strategic relationship is based almost exclusively on offensive forces, particularly on the U.S. side, and it will remain so under START. A more balanced offense/defense posture would be more compatible with a U.S.-Soviet relationship that is evolving in less threatening and confrontational ways. Under these circumstances, deterrence could be based increasingly on the ability to deny the objectives of a nuclear attack. Damage denial appears to be an effective way of deterring attacks, whether they are Soviet or third-country in origin.

Recognizing this, U.S. arms reduction objectives and the SDI program are designed to facilitate this evolution through the reduction of offensive forces, the introduction of strategic defenses, and a balanced strategic posture involving a mix of offensive and defensive forces. In the Defense and Space Talks in Geneva, the U.S. seeks a more stable and secure basis for deterrence in the future through a cooperative transition to a balanced strategic posture including strategic defenses.

To date, the Soviet Union has made clear its objective of limiting strategic defenses by "strengthening" the ABM Treaty. In some cases, strengthening means constraining strategic defense activities more than they are constrained by the ABM Treaty itself. It is our hope that the Soviets will engage with us more seriously in these talks in the future. In this regard, we were very pleased with the outcome of the recent Washington Summit. In the Joint Statement on Follow-on Strategic Negotiations, the Soviet Union agreed to continue the Defense and Space Talks "without delay" with the objective of "implement(ing) an appropriate relationship between strategic offenses and defenses." This is much more consistent with the U.S. agenda than it is with the Soviet agenda of preserving the status quo, and we view it as a positive step. If we are to see further Soviet movement in our direction in the Defense and Space Talks, your support for the SDI program is essential. If the Soviets are convinced that Congressional funding reductions will preclude SDI from ever becoming a reality, they will have little incentive to negotiate with us seriously in Geneva.

We are cautiously optimistic that if we continue to pursue an aggressive and technically sound SDI program, and if we get Congressional support for that program, then the Soviet position regarding strategic defenses may become more positive. In fact, there have already been some signs of a more positive Soviet attitude toward strategic defenses. Some Soviet analysts, including their uniformed military, have pointed out that ballistic missile proliferation threatens the Soviet Union more directly that it threatens the United States, and they have admitted that strategic defenses would be more compatible with the stated Soviet interest in a "defensive doctrine". Such a change in thinking on their part would enable us to agree to a more stable and secure basis for deterrence in the future. It would also provide a lasting basis for a less threatening strategic relationship more consistent with the improvements in our overall relationship.

In sum, Mr. Chairman, the Department of Defense has carefully reviewed the requirement for strategic defenses in light of the changing international security environment. While the nature and scope of the threats we face are changing, we find that strategic defenses can provide a unique and vital contribution to our defense posture. We are in the process of analyzing the refinements needed to our strategic defense architecture to address the changing nature of the threat, and we hope to complete this effort in the months ahead. We also believe we have integrated broad U.S. strategic and arms reduction objectives with our objectives for the SDI program in a comprehensive and coherent manner. The resulting strategy not only protects vital U.S. interests in light of the threats we foresee in the future, but it provides a foundation for positive and enduring improvement in the U.S.-Soviet relationship.

Senator EXON. Mr. Secretary, thank you very much.

Now we turn to General Monahan. And just let me say, General Monahan, once again, as I did in my opening statement, how deeply indebted we are on this committee to the excellent work that you have done over the years. Although you are going to retire, and you have certainly earned that retirement, we are going to miss you here. We are very pleased that you agreed to come up today to give us your last and best shot on SDI.

I am pleased to welcome you, General.

STATEMENT OF LT. GEN. GEORGE L. MONAHAN, JR., U.S. AIR FORCE, DIRECTOR, STRATEGIC DEFENSE INITIATIVE ORGANIZATION

General MONAHAN. Thank you very much, Mr. Chairman. It is indeed a pleasure to be here with you again. And thank you very much for those very, very kind remarks, and the remarks of Senator Thurmond. It has been a privilege to have been able to serve this long, and a real honor to have been able to do so, and also, to spend the last couple of those 35 years working on the SDI program.

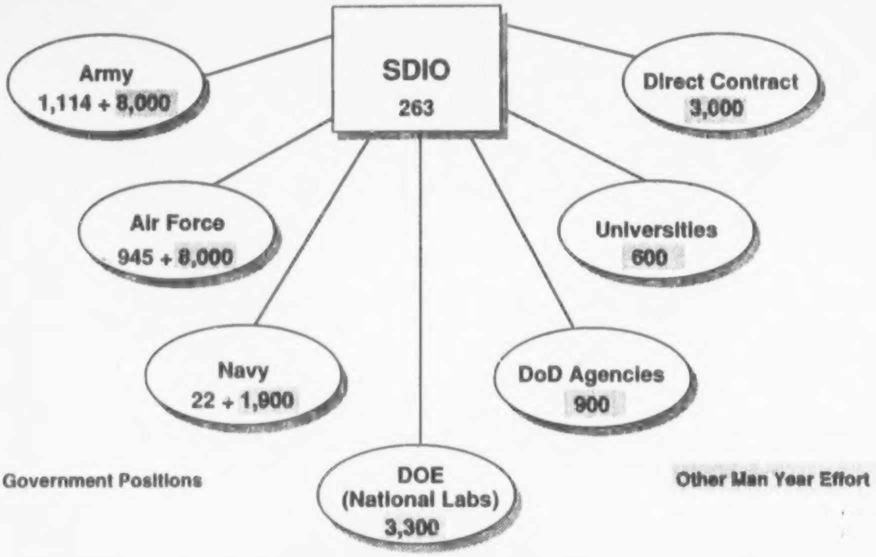
In order to summarize what I have in the statement, I have a presentation to make that I think illustrates, and we will try to go through this rather quickly, some of the most important points that we would like to make.

OUTLINE

- ➡ FY 91 Program Overview
- Brilliant Pebbles
- Technology Achievements
- Summary

These are the areas we will cover.

COORDINATED NATIONAL EFFORT



SDIO
263

Army
1,114 + 8,000

Direct Contract
3,000

Air Force
945 + 8,000

Universities
600

Navy
22 + 1,900

DoD Agencies
900

DOE
(National Labs)
3,300

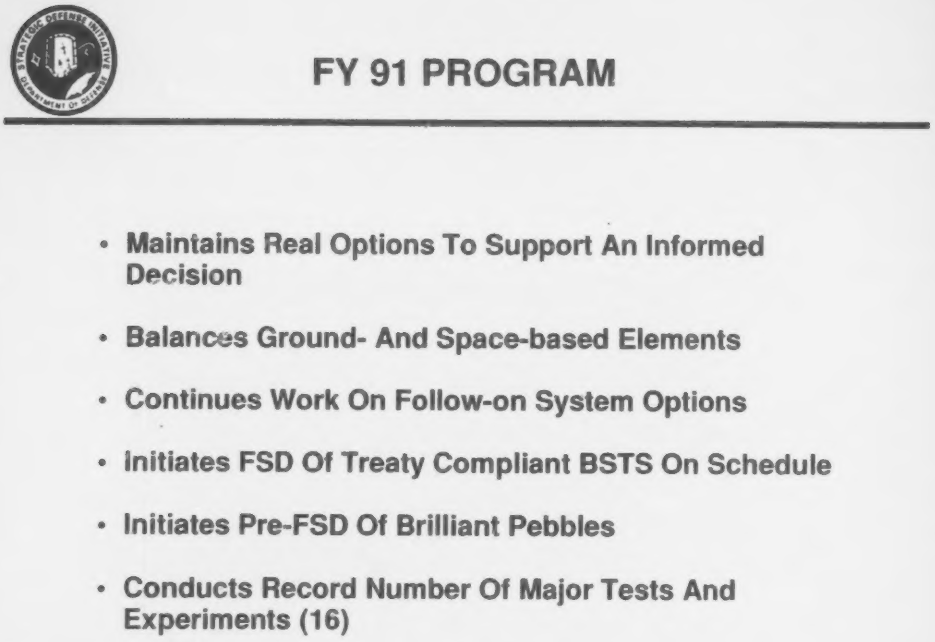
Government Positions

Other Man Year Effort

Approximately 28,000 Man Years

I guess this does not really show up so well under the bright lights, but we have about 28,000 people around the country who are working on the program today. You can see there the number of people in the Army, the Air Force, and the Navy. We have a lot of work done for us by the Army and the Air Force and other agencies. A considerable amount of work is done by the Department of Energy laboratories.

In fact, the work that they do at Sandia, Livermore, and Los Alamos, for example, is absolutely of the highest order. We also have universities involved. So what we have today is really a team of people out there pursuing SDI and working on it very diligently. One thing I think would be very important for the country is to make sure that we keep that team together and it does not get dismantled.



FY 91 PROGRAM

- Maintains Real Options To Support An Informed Decision
- Balances Ground- And Space-based Elements
- Continues Work On Follow-on System Options
- Initiates FSD Of Treaty Compliant BSTS On Schedule
- Initiates Pre-FSD Of Brilliant Pebbles
- Conducts Record Number Of Major Tests And Experiments (16)

And what are we going to do in fiscal year 1991?

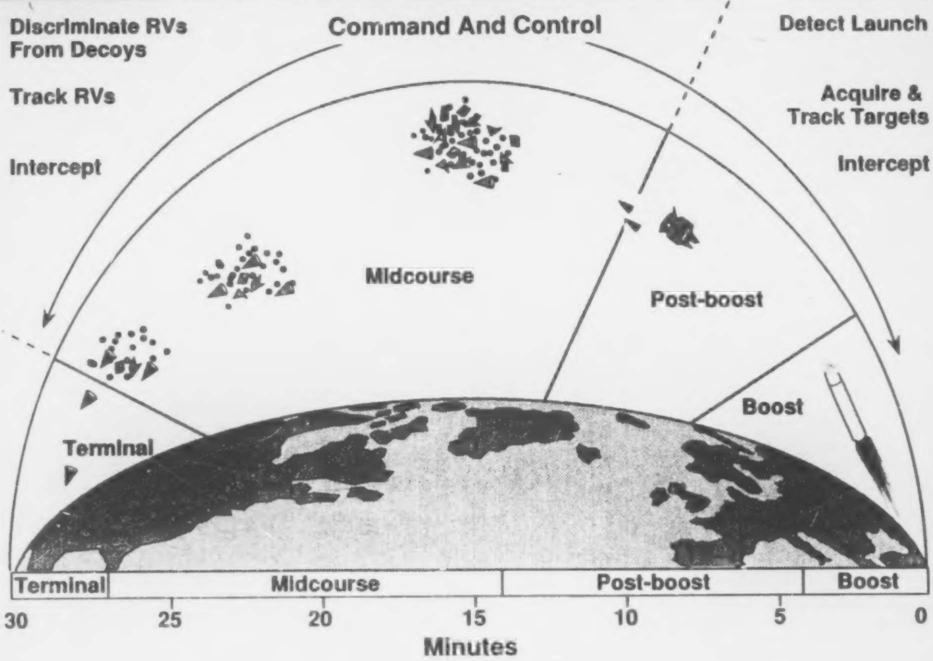
Well, the President has told us that he wants to make an informed decision on whether or not to deploy such a system here within just a couple of years. So our activities are aimed at being able to allow the President, and the national leadership, to do just that.

To do that, we are trying to maintain a balance between the ground- and the space-based elements, and I am going to describe those just very briefly in a moment, and continuing work on the follow-on systems. In other words, the directed energy weapons of the future.

Something very important, and I think we can talk about it later, is that we would initiate full-scale development of a treaty-compliant Boost Surveillance and Tracking System satellite. That one is really not needed now for SDI, now that we have Brilliant Pebbles. I will describe that later. Then we would initiate what we call pre-full-scale development of Brilliant Pebbles.

I will also later describe a record number of major tests and experiments that we will conduct.

BALLISTIC MISSILE DEFENSE CHALLENGES


Discriminate RVs From Decoys
Track RVs
Intercept
Command And Control
Detect Launch
Acquire & Track Targets
Intercept
Midcourse
Post-boost
Boost
Terminal
Terminal
Midcourse
Post-boost
Boost
30
25
20
15
10
5
0
Minutes

Let me just briefly explain the problem here, and review for you once more what we face in trying to intercept ballistic missiles. This shows the trajectory of a ballistic missile, about 30 minutes in length. We divide that into four very distinct phases, boost, post-boost, midcourse, and terminal.

In the boost phase, there is a large booster with many warheads on top and a very nice long plume behind it that provides very, very good signatures. It is a good time to attack, because, if it is an SS–18 for example, it has 10 warheads, we can get all 10 warheads at once. Unfortunately, this phase is short, so we have to make decisions very, very quickly. Our interceptors have to be designed to be able to act very rapidly.

The post-boost phase is another good time to intercept. In the post-boost there is still a good plume signature, but now the post-boost vehicle is dropping off the warheads, one by one. During that phase, it is following a very, very precise trajectory. So, again, it is a good time to intercept.

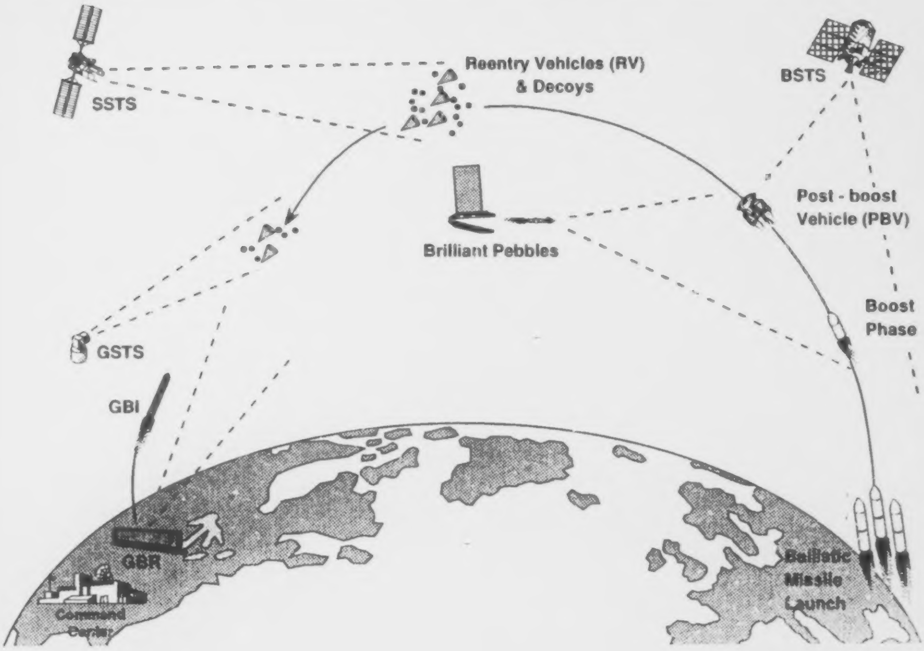
We get into the midcourse then. The midcourse has the advantage of being quite long. So there is a lot of time for decisionmaking. But the problem is that we can expect to see decoys accompanying the reentry vehicles themselves. So then we are faced with the problem of discriminating between the decoys and reentry vehicles.

At the present time we do not know of any adversaries who have decoys, but we know that it is possible to do so.

Finally, we get to the terminal phase. The terminal phase has the advantage of stripping out the decoys by the atmosphere. The lightweight decoys are being stripped out by the atmosphere, so we do not have to worry about discrimination. But it is a rather short time period. It is kind of a last ditch effort. And we have to worry also about aerodynamic effects.

So that just kind of sets the stage for what the problem is.

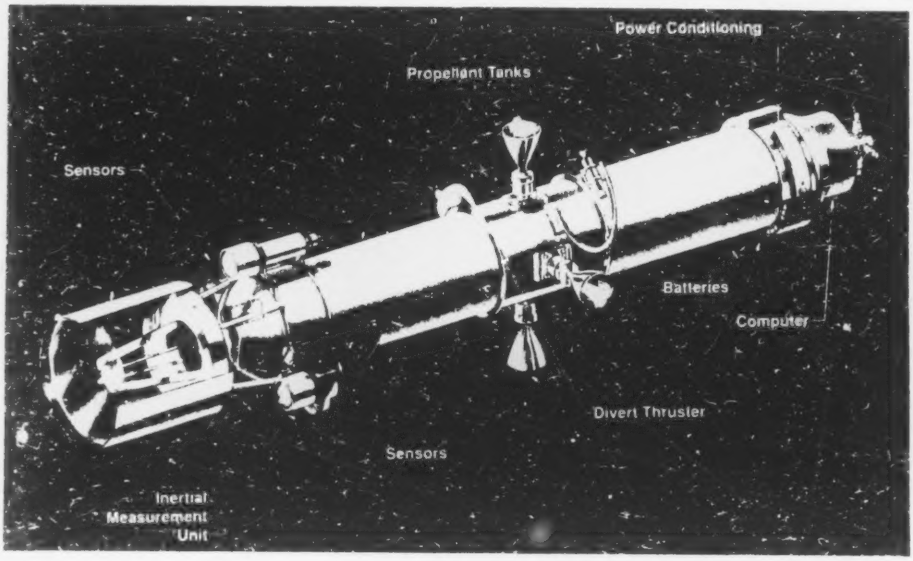
SDS PHASE I ARCHITECTURE


Reentry Vehicles (RV)
& Decoys
SSTS
BSTS
Post - boost
Vehicle (PBV)
Brilliant Pebbles
Boost
Phase
GSTS
GBI
GBR
Command
Center
Ballistic
Missile
Launch

Let us just look at what we call the Phase I architecture. You see there the Brilliant Pebbles. And I am going to describe them in more detail. It has the role of intercepting in both the boost and the post-boost phase. The ground-based elements of the architecture, the ground-based interceptor, GBI, is the interceptor that would intercept in the midcourse, or late in the midcourse phase. It is assisted by the SSTS, Space Surveillance and Tracking System, and the GSTS, Ground Surveillance and Tracking System, sensors which are very similar sensors that get up close to those clusters of reentry vehicles and decoys and discriminate between them.

Finally, there is a ground-based radar, or GBR, that also assists in the discrimination process. And a command center that has both fixed and mobile elements that pulls it all together.

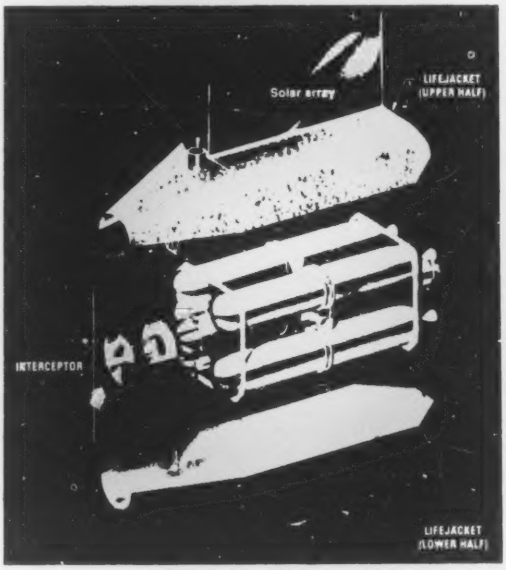
BRILLIANT PEBBLES INTERCEPTOR


Power Conditioning
Propellant Tanks
Sensors
Batteries
Computer
Divert Thruster
Sensors
Inertial Measurement Unit

We adopted the Brilliant Pebbles as our space-based side of the architecture after a very extensive study last year, not only by ourselves but by independent groups such as the JASONS and the Defense Science Board. And here is just a brief description of what that interceptor looks like. This is without its life jacket. But it has several sensors on board, infrared, visible, and ultraviolet. It has a laser radar for purposes of communication, and for distinguishing between missile plumes and hard bodies.

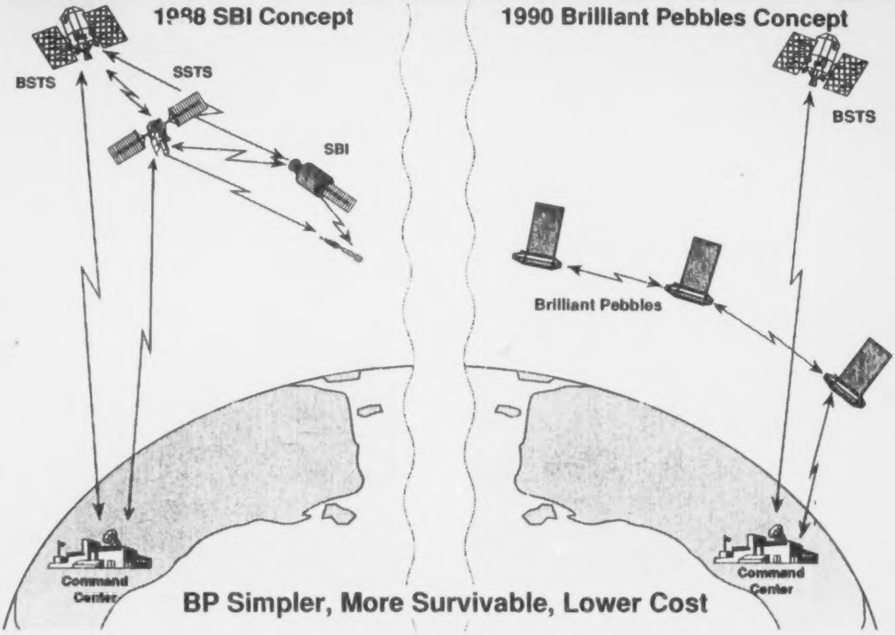
I am going to describe some high technology in a few minutes here, some technical achievements, but what really makes this possible is, as you note there, those thrusters. Those thrusters, the lateral thrusters, divert thrusters, that are capable of tremendous thrust-to-weight ratios that just were not possible a few years ago. And also, very small computers and those very powerful but small sensors.

BRILLIANT PEBBLES INTERCEPTOR AND LIFE JACKET


Solar array
LIFEJACKET (UPPER HALF)
INTERCEPTOR
LIFEJACKET (LOWER HALF)

This is the Brilliant Pebble interceptor in a life jacket and the cluster of fuel tanks around it that provide the axial acceleration. What you see there would weigh about 100 pounds, and it is about a yard long. Also, you can see a knob there just in front of the solar array, and that is the star tracker, the wide field of view star tracker. That allows each pebble to know where it is and where it is going at all times, and can report that back to our computers.

BOOST PHASE ENGAGEMENT


1988 SBI Concept
BSTS
SSTS
SBI
Command Center
1990 Brilliant Pebbles Concept
BSTS
Brilliant Pebbles
Command Center

BP Simpler, More Survivable, Lower Cost

By adopting Brilliant Pebbles, we have been able to greatly simplify the space-based part of the architecture. Over on the left-hand side of the chart you see what that architecture looked like a couple of years ago under what we called the space-based interceptor, or SBI concept. In that case, a number of satellites, and the BSTS, the SSTS, and the carrier vehicles, and the interceptors themselves had to talk to each other. So it was a complicated arrangement. There was opportunity for things to go wrong, and too much opportunity for jamming of radio communications.

In the case of Brilliant Pebbles, we eliminated a lot of that complexity, made it a lot simpler, and the pebbles really only need to talk to someone on the ground who gives them the order that they may fire or may launch to intercept. There is a very robust communication scheme to do so.

BRILLIANT PEBBLES ACQUISITION APPROACH

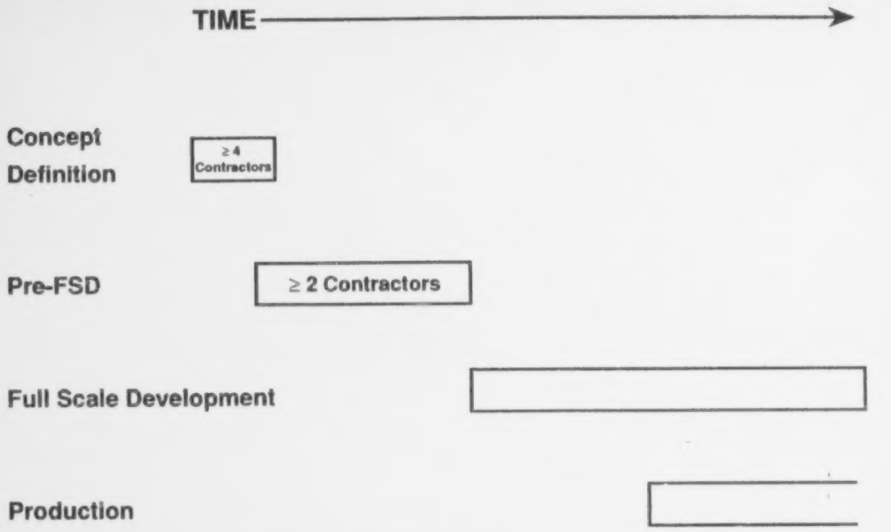
Highly Streamlined Management Approach To Bring Industry Onboard

- **Maintain Simplicity And Low Cost Features**
- **No Mil Specs Or Standards In Pre-FSD**
- **Direct, Streamlined Reporting**
- **Encourage Industrial Innovation And Creativity**

In the Brilliant Pebbles program we are going to take an approach here that the defense management review that was very recently conducted allows us to do now, to try to do things in a more streamlined fashion, to do them quicker, to do them with less in the way of paperwork and burden. And so we are trying to now bring industry on board through this approach, trying to maintain simplicity in the low-cost features of Brilliant Pebbles.

For example, in the pre-FSD phase, we are not going to impose military specifications or standards; we are simply going to tell the contractors what we want as the end product. We will tell them what to do, not how to do it. We will specify, for example, the lifetime we desire out of each pebble, but we will not tell them how to go about ensuring that that happens.

PLANNED CONTRACT PHASES



TIME

Concept Definition

≥ 4 Contractors

Pre-FSD

≥ 2 Contractors

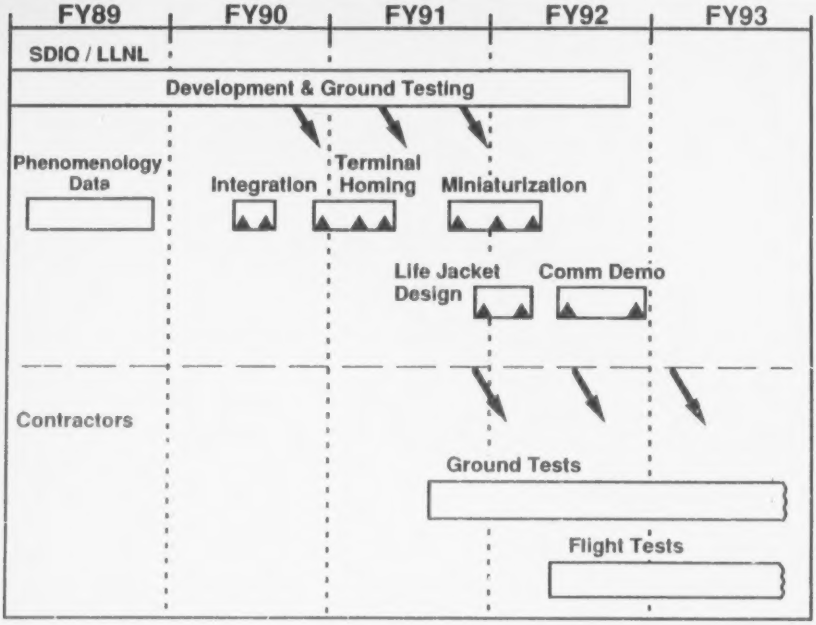
Full Scale Development

Production

This is just a rough look at the schedule associated with that, and the way we are doing it at the present time. We are in a concept definition phase with six contractors, as shown there. Next year we will knock that down to probably two contractors for pre-FSD, and finally, into full-scale development here in just a few years. The dates are off the chart just to keep it from being classified.

And finally, before the turn of the century, we could deploy the first pebbles.

BRILLIANT PEBBLES INITIAL TEST PROGRAM

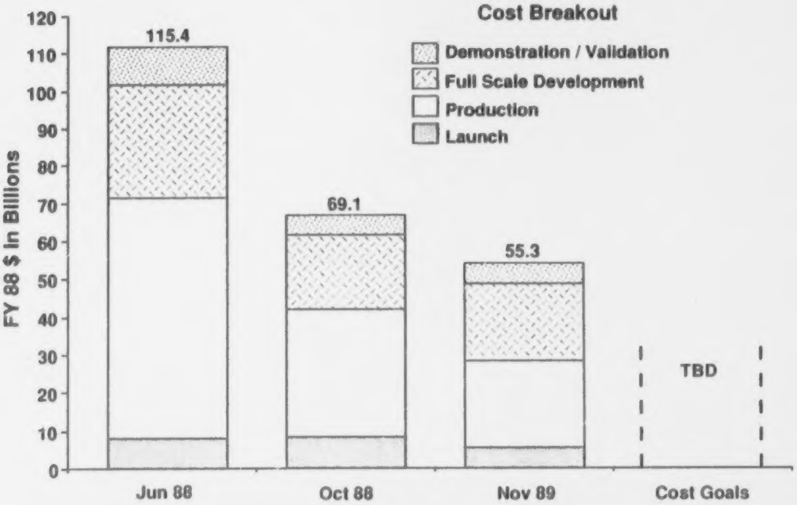

FY89
FY90
FY91
FY92
FY93
SDIO / LLNL
Development & Ground Testing
Phenomenology Data
Integration
Terminal Homing
Miniaturization
Life Jacket Design
Comm Demo
Contractors
Ground Tests
Flight Tests

This is a look at the test program we are just about to initiate. The first test of Brilliant Pebbles will occur this summer. The first series of tests up there under fiscal year 1990, it says integration, is what we are just about to initiate. And those tests on that line there, all eight tests, are suborbital. We made them that way very deliberately so that they would be compliant with the restrictive interpretation of the ABM Treaty.

The tests labeled life jacket design and communications demo are orbital, but they do not have interceptors on board.

Finally, we will be getting on board as I described just a moment ago, and they will be conducting ground tests and flight tests out in the time period of about 1992 or 1993.

SDS PHASE I COST REDUCTIONS



Now, by adopting Brilliant Pebbles, we were able to reduce the cost of the first phase of the program. Our estimate at this time is that Phase I, as I described it there, that consists again of the ground-based interceptors, as well as the Brilliant Pebbles in space, is about $55 billion.

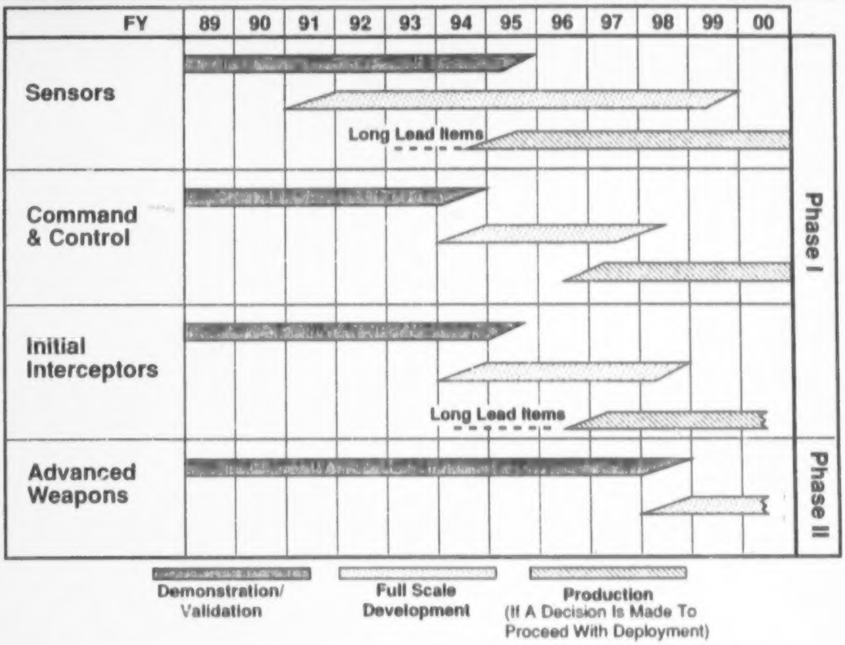
We have efforts underway at the present time where we are looking very hard at the midcourse and terminal phase of the intercept, where we have the ground-based interceptors, the GSTS, SSTS sensors, and ground-based radar, trying to see if there is a way to simplify that. Just as last year, we simplified the space-based side by adopting Brilliant Pebbles, now we are trying to do the same with the ground-based and the midcourse and terminal portion of it.

So cost goals, as I say, are to be determined, but that clearly can be done.

I think there is an important point here. These, of course, are not all the funds that we would spend within SDI. For example, next year about half of the funds we requested are for the first phase of the program. The rest are for the theater program, the follow-on program, the directed energy systems, et cetera. So, obviously, we would not be spending just $55 billion as we proceeded with Phase I. There would be other supporting work going on, and work looking out toward the future, also.

But the point is that this is not what I would consider to be an incredibly unaffordable program as far as strategic programs are concerned. It is not one-half trillion dollars or a quarter of a trillion or anything of that sort. It is more or less in this regime.

SDS PROGRAM SCHEDULE



This just gives a quick look at the program schedule in an unclassified sense. You will note there the initial interceptors, and when we would ask for production funds. It will be out in the late 1990s sometime before we would deploy.

FY 90-91 PROGRAM CHANGES

($ In Millions)

	FY 90	FY 91
Phase I	1688.0	2350.6
Follow-on	840.2	984.4
Key Technologies	284.7	337.1
Operational Support / Mgmt	261.4	239.7
Test & Evaluation	189.5	217.3
Theater Defense	124.7	131.8
IS&T / SBIR	113.4	116.8
Engineering Analysis	102.9	93.7
Total	$3604.8	$4471.4

Includes MILCON

STRATEGIC DEFENSE INITIATIVE FY 91 PROGRAM

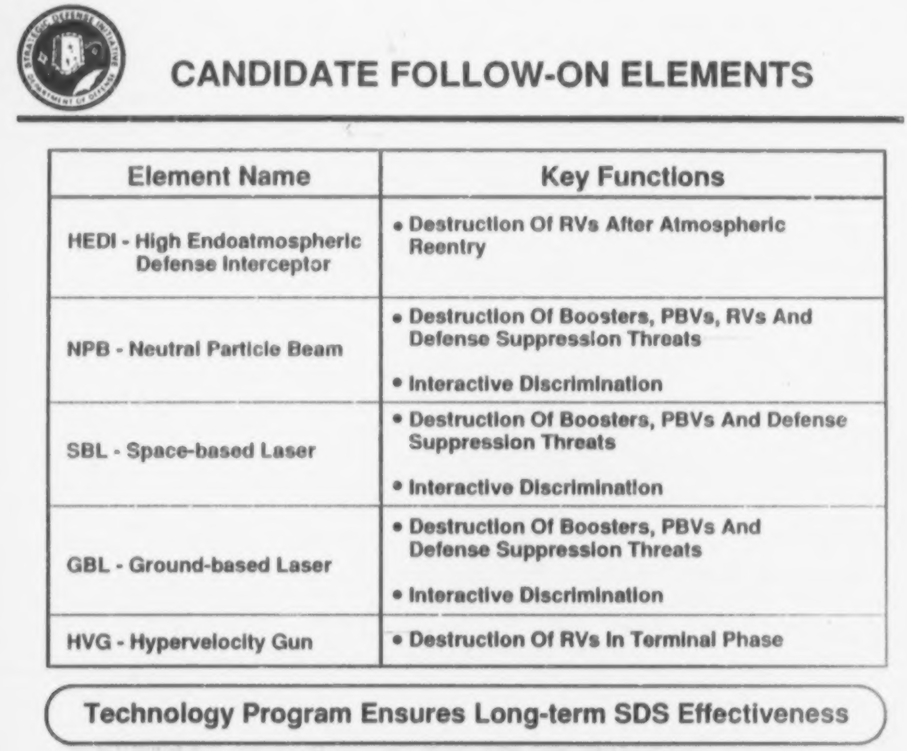
($ In Millions)

RDT&E Program Elements	FY 91
Surveillance, Acquisition, Tracking & Kill Assessment	1,306.7
Directed Energy Weapons	802.9
Kinetic Energy Weapons	1,017.7
Systems Analysis / Battle Management	674.0
Survivability, Lethality & Key Support Technologies	393.6
Full Scale Development (BSTS)	265.0
Total RDT&E	4,460.0
MILCON	11.4
DoD Total	4,471.4
DoE SDIO	191.9
DoD / SDIO	4,663.3

Here, very briefly, is where we would intend to allocate the funds for next year. And this is the number that was mentioned earlier of about $4.5 billion. You note, as I said, that most of it goes for the first phase of the program, for Phase I, and then the follow-on are the directed-energy weapons that I will talk about in just a moment. And the rest of it stays pretty much the same.

So the major increases that we are looking at for next year are for the first phase of the program, and for the directed-energy weapons and the follow-on. We are trying to be as efficient as we can in the way of overhead.

For example, there you see operational support and management. We intend to cut the funds for that next year. Theater defense goes up just a little bit. We are cutting the funds for engineering analysis. We want to get out of the paper stage and get more into the hardware stage, and that is just where we are going right now.



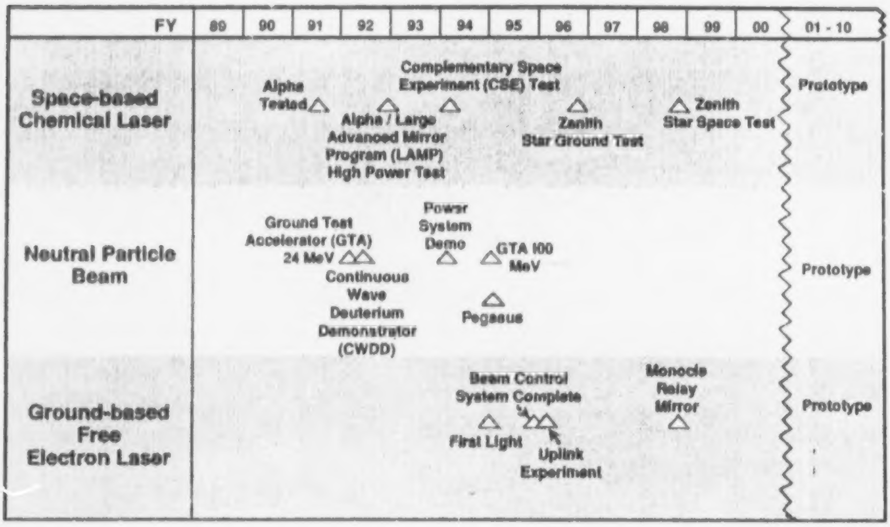
CANDIDATE FOLLOW-ON ELEMENTS

Element Name	Key Functions
HEDI - High Endoatmospheric Defense Interceptor	• Destruction Of RVs After Atmospheric Reentry
NPB - Neutral Particle Beam	• Destruction Of Boosters, PBVs, RVs And Defense Suppression Threats • Interactive Discrimination
SBL - Space-based Laser	• Destruction Of Boosters, PBVs And Defense Suppression Threats • Interactive Discrimination
GBL - Ground-based Laser	• Destruction Of Boosters, PBVs And Defense Suppression Threats • Interactive Discrimination
HVG - Hypervelocity Gun	• Destruction Of RVs In Terminal Phase

Technology Program Ensures Long-term SDS Effectiveness

Let us talk for a moment about the candidate follow-on elements. I described the first phase of the program that relied on the kinetic energy interceptors. Now, looking out into the future, we have the neutral particle beam, spaced-based laser, and ground-based laser as directed energy weapons. And then the possibility of using the HEDI, High-Endoatmospheric Defense Interceptor, as a terminal tier interceptor.

DIRECTED ENERGY PROGRAM



This shows a brief schedule for the directed energy part of the program. Note that over in the far right-hand side there I just put down in the year 01 to 2010, prototype, prototype, prototype. That simply says that somewhere out there after the turn of the century we could have weapons-grade prototypes tested for the first time. The precise schedule on that is really financially limited, more than anything else.

But some important events do happen during the 1990s. For example, the space-based chemical laser. We have the complementary space experiment test in 1994, in which we would operate a very reduced size laser in space for the first time.

With the neutral particle beam, the Pegasus satellite in 1995 would be the first time we would operate a reduced-power neutral particle beam satellite in space.

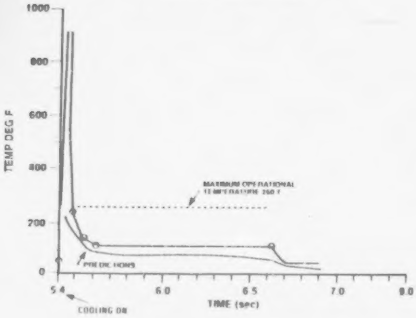
With the ground-based free electron laser, as we see it now, if we could stay on course with it, about 1995 would be the first operation of that laser.

HEDI PROGRAM

1ST FLIGHT TEST 26 JAN 90

TECHNOLOGY ACHIEVEMENTS

- SHROUD REMOVAL AT HIGH DYNAMIC PRESSURE
- FOREBODY AND WINDOW COOLING
- WARHEAD DETONATION



This is the HEDI that had a very successful flight test on the 26th of January. The curve that I provided with this chart shows the cooling of the window that the sensors have to look through. We had to get it cooled down to 260 degrees. We did not know if we could or not. Analysis said it was going to be close. But we indeed got it cooled down to about 140 degrees.

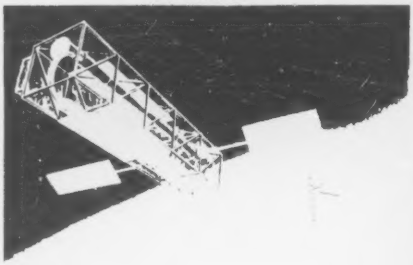
So that and a couple of other things have given us a lot of encouragement to proceed perhaps more rapidly with the terminal tier type efforts.

NEUTRAL PARTICLE BEAM PROGRAM

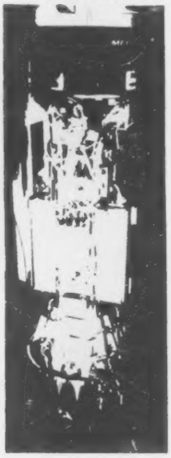
BEAR EXPERIMENT

- SUCCESSFUL OPERATION OF PARTICLE ACCELERATOR (BEAR) 13 JUL 89 WAS FIRST OPERATION OF A DIRECTED ENERGY SYSTEM IN SPACE
- GROUND DEMONSTRATION OF PEGASUS FLIGHT HARDWARE 1992

CONCEPT

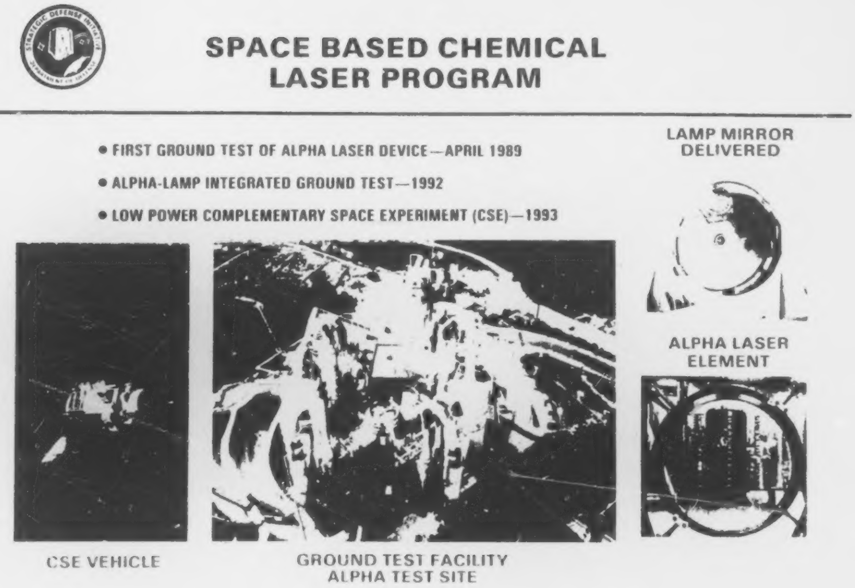


BEAR PAYLOAD



Last summer we operated a neutral particle beam in space for the first time in what we called the BEAR Experiment, Beam Experiment Aboard Rocket, in New Mexico. It was a very successful test. The particle beam was generated properly. It propagated properly through space and then when it got into atmosphere it started to ionize and it broke up. But a very successful test of the neutral particle beam.

This is technology that really is more financially limited than anything else. We could move faster if we had the funds available to do so.



SPACE BASED CHEMICAL LASER PROGRAM

- FIRST GROUND TEST OF ALPHA LASER DEVICE—APRIL 1989
- ALPHA-LAMP INTEGRATED GROUND TEST—1992
- LOW POWER COMPLEMENTARY SPACE EXPERIMENT (CSE)—1993

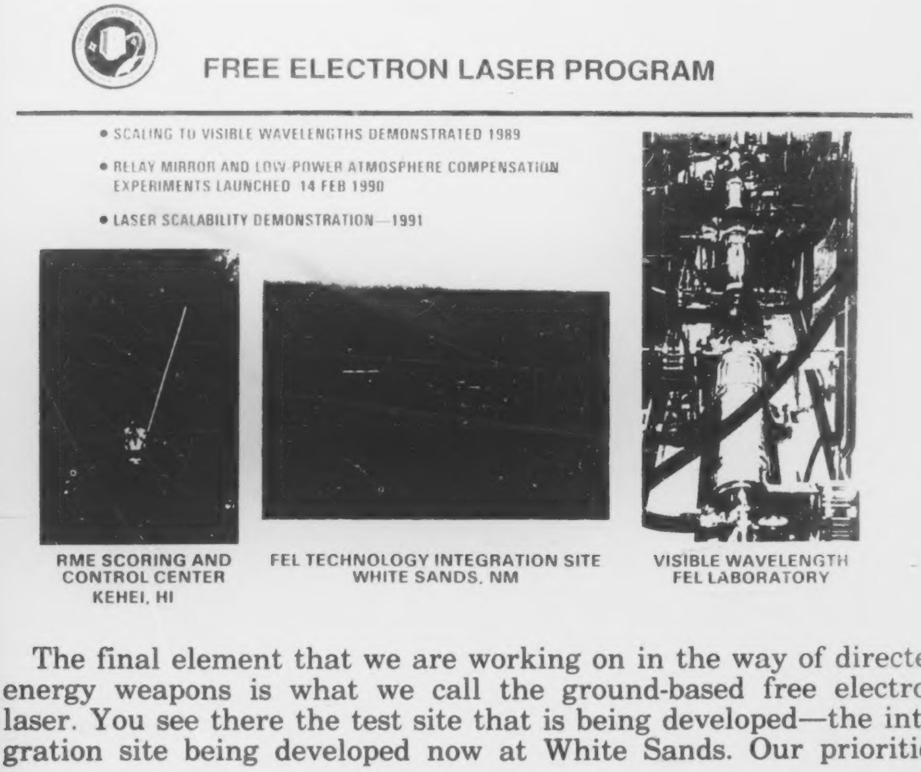
LAMP MIRROR DELIVERED

ALPHA LASER ELEMENT

CSE VEHICLE

GROUND TEST FACILITY
ALPHA TEST SITE

The space-based chemical laser shown here is the laser that we are now operating and testing, in California, in a very elaborate test setup that simulates space. This facility, as well as the neutral particle beam facility, by the way, were visited by a team of Soviet scientists, last December.



FREE ELECTRON LASER PROGRAM

- SCALING TO VISIBLE WAVELENGTHS DEMONSTRATED 1989
- RELAY MIRROR AND LOW-POWER ATMOSPHERE COMPENSATION EXPERIMENTS LAUNCHED 14 FEB 1990
- LASER SCALABILITY DEMONSTRATION—1991

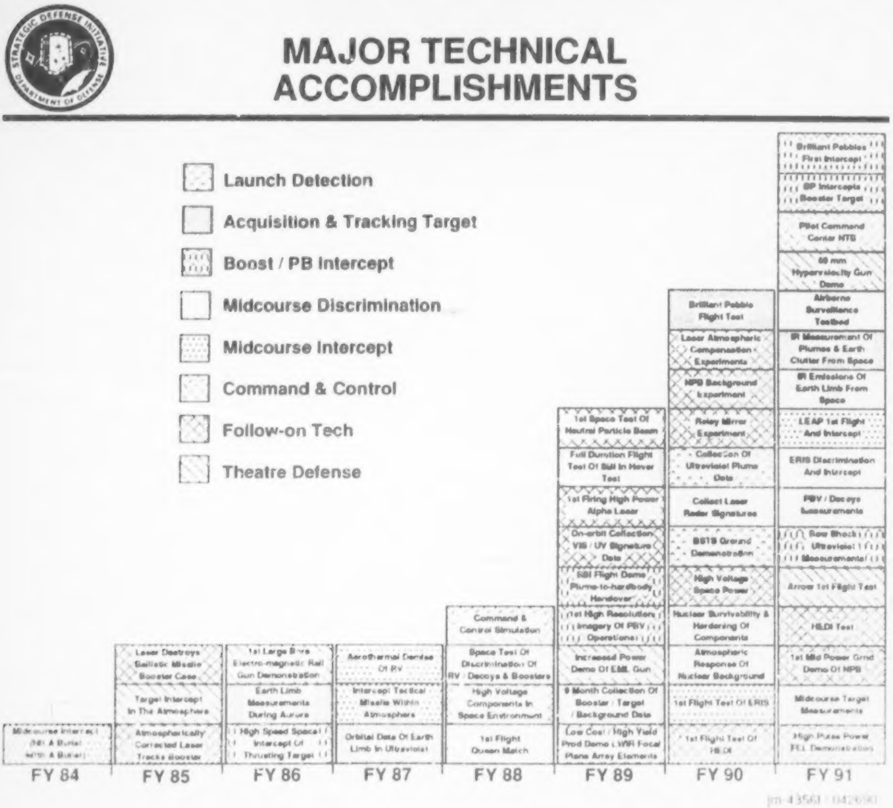
RME SCORING AND
CONTROL CENTER
KEHEI, HI

FEL TECHNOLOGY INTEGRATION SITE
WHITE SANDS, NM

VISIBLE WAVELENGTH
FEL LABORATORY

The final element that we are working on in the way of directed energy weapons is what we call the ground-based free electron laser. You see there the test site that is being developed—the integration site being developed now at White Sands. Our priorities here are to get that infrastructure built up at White Sands, and then, with available funding, to proceed with the design and development of the laser itself.

But, as I said, these three directed energy weapons are really funding-limited as far as what schedules could possibly be made. Now, they are at the same time, though, very, very lethal, because, for example, with the neutral particle beam weapon, you can take several shots per second at a target thousands of miles away.

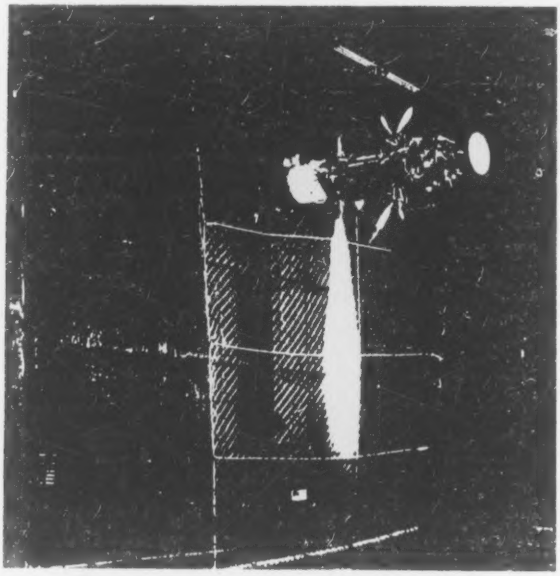


Somebody mentioned earlier that about $3 billion a year on the average has been authorized and appropriated on SDI now for the past several years.

Well, what has become of that?

Here is one good illustration. I do not expect that you can read all of the fine print on here, although in your books perhaps you can see it better. But the point is that over the period of the past couple of years, and looking out into 1991 and beyond, there is a very rapid rise in major tests and major experiments here in the program. So that says things are getting off the drawing boards, getting off the design tables, getting out of the laboratories, and finally getting into very, very meaningful tests.

ON TARGET FREE FLIGHT



TECHNOLOGY ACHIEVEMENTS

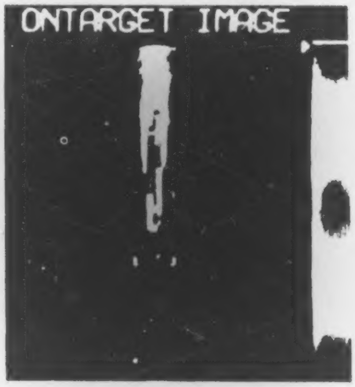
- ALL FUNCTIONS INTEGRATED ON-BOARD
- TARGET DETECTED AND TRACKED
- VEHICLE STABILITY DEMONSTRATED
- FULL DURATION FLIGHT PROFILE

One of those very meaningful tests is one that is described here, a series that we conducted last summer and last fall, we call it the On Target Test or Free Flight Test. In this case, at Edwards Air Force Base, this generic space-based interceptor vehicle has on board all the necessary functions to intercept in space, to hit a bullet with a bullet, if you will.

With the exception of the axial propulsion system, it was tested very successfully in a whole series of tests. As a matter of fact, we canceled the last two tests because we had accomplished all of our objectives before and did not really need to spend any more effort on them.

IR TRACKING OF BOOSTER TARGET

HgCdTe IR
FOCAL PLANE CHIP

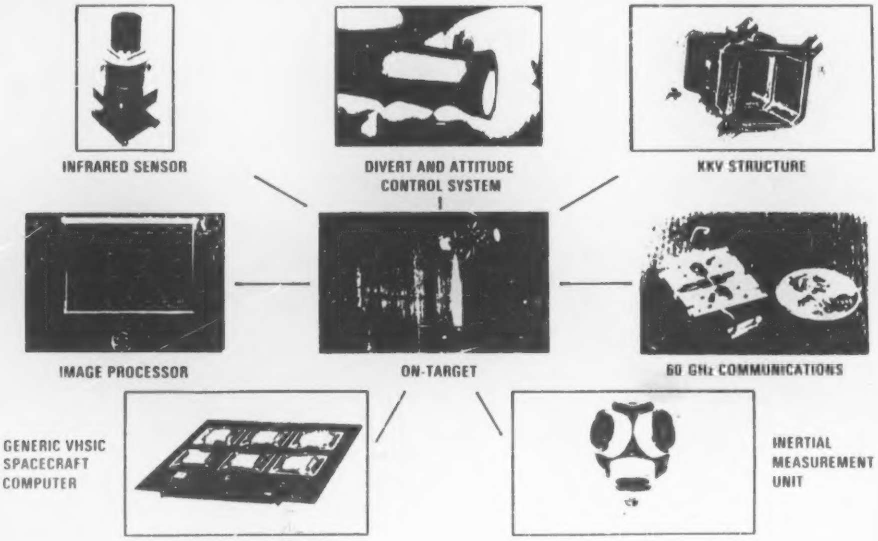


GAPP-BASED IMAGE PROCESSOR OUTPUT SHOWING
AIMPOINT LOCATED IN ROCKET PLUME

- 64 × 64 ARRAY (4096 PROCESSORS)
- 2,660 MIPS

In that test, we also had the interceptor try to lock on to a rocket that is mounted nose down several kilometers away, outside the hangar. Indeed it was able to do so and to track and to track between the missile plume and the hard body of the missile. That is made possible, among other things, because of this excellent and very miniature focal plan chip that is shown there on the left.

TECHNOLOGY INTEGRATION



INFRARED SENSOR

DIVERT AND ATTITUDE CONTROL SYSTEM

KKV STRUCTURE

IMAGE PROCESSOR

ON-TARGET

60 GHz COMMUNICATIONS

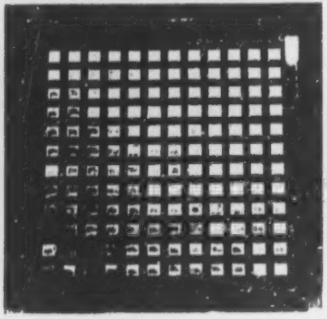
GENERIC VHSIC SPACECRAFT COMPUTER

INERTIAL MEASUREMENT UNIT

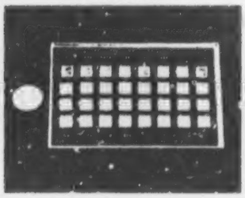
In the next chart you will see a number of other items I am going to describe in a little bit more detail that make this kind of technology or this kind of effort possible.

PARALLEL PROCESSING TECHNOLOGY

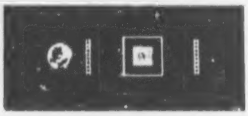
BRASSBOARD



GAPP-BASED FLIGHT TEST COMPUTER



HIGH DENSITY STACKING



	GAPP II-BASED IMAGE PROCESSOR (1987)	GAPP III-BASED IMAGE PROCESSOR (1990)	GAPP III (MID 90s)
THROUGHPUT			
OPERATIONS/SEC	—40 GOPS	—40 GOPS	—82 GOPS
INSTRUCTIONS/SEC	—1,250 MIPS	—2,562 MIPS	—2,562 MIPS
SIZE	—8.2 FT^3	—0.44 FT^3	—0.25 IN^3
WEIGHT	—45 LB	—1.2 LB	—0.1 LB
HARDNESS	—NON	—NON	—RADIATION HARD

One of them is the processor that was used in those tests, and this is the one we call the Geometric Arithmetic Parallel Processor. You can see that the one on the left was what we used in tests last year and the one in the middle is one we will be using in tests this year. The one last year and this year operate at 40 billion operations per second.

To put that in perspective, a Cray III supercomputer operates at about 1 billion operations per second. With that capability, it can add all the Social Security numbers in the United States in about a quarter of a second.

Well, this is about 40 times the operating power there. Of course, it does not have the memory capability of a Cray; it does not need it. And you note that, looking out into the future, we are going to have it even smaller yet.

INERTIAL MEASUREMENT TECHNOLOGY

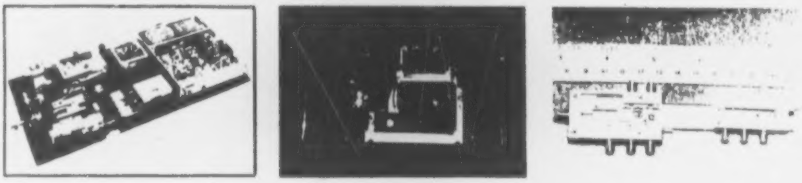
	1970s	1980s	EARLY 1990s	EARLY 1990s	MID 1990s
	GIMBALLED IMUs MECHANICAL GYROS	STRAPDOWN IMUs RING LASER GYROS	SOLID STATE IMUs FIBER-OPTIC GYROS	QUARTZ IMUs TUNING FORK GYROS	MICRO-MECHANICAL IMUs
	40 LB	~ 10 LB	~ 1 LB	< 4 OZ	< ½ OZ
	$70,000	$100,000	$5,000	$5,000	$500
	NAVIGATION GRADE	NAVIGATION GRADE	NAVIGATION GRADE	TACTICAL GRADE	TACTICAL GRADE
ACCURACY	005 DEGS/HR	015 DEGS/HR	03 DEGS/HR	1 DEG/HR	10 DEGS/HR

This is one area where I think we made some great strides in SDI work. What we are showing on the left is what we call an inertial measurement unit or a navigation unit that is used on our modern fighter airplanes, such as the F-16. It weights about 40 pounds and costs about $70,000. It is late-1970s technology.

What you see there in the middle, where it says early 1990s, is a solid state IMU fiber optics gyro. It weighs about 1 pound and costs about $5,000. It has no moving parts, and operated very successfully. We are looking, as you can see, out in the future, where it will be even smaller still. One that we tested, and I have it here with me, is the quartz IMU. It weighs about 4 ounces, and costs about $5,000, and perhaps even less than that.

COMMUNICATIONS COMPONENT DEVELOPMENT

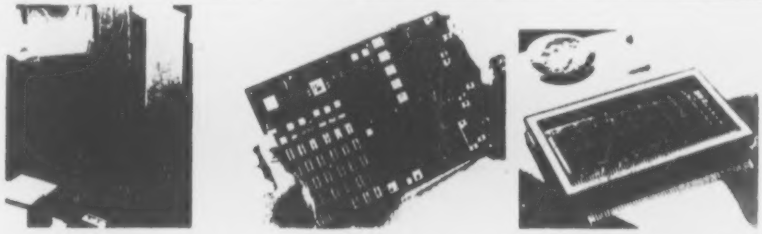
PROGRESS IN COMMUNICATIONS TECHNOLOGY
(60 GHZ COMMUNICATIONS RECEIVER)



	1979	1985	1989
PRODUCTION	~ 180 MAN DAYS	~ 30 MAN DAYS	~ 2 MAN DAYS
WEIGHT	≅ 60 LBS	≅ 3 LBS	≅ 1.3 OZ
POWER CONSUMPTION	40 WATTS	20 WATTS	5 WATTS

In the radio world, or the RF world, you can see what has happened in the way of miniaturization of 60 gigahertz communications equipment over a period of 10 years, a dramatic reduction in what it takes to produce, a dramatic reduction in weight, a dramatic reduction in power consumption.

COMPUTER ADVANCES

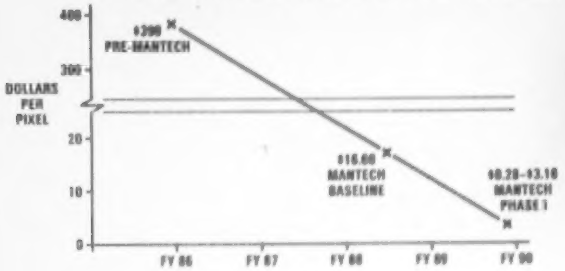


	CRAY 1	BP FLIGHT TEST COMPUTER—1989	BP FLIGHT COMPUTER—1991 (1 OF 4 MODULES)
PROCESSORS	1	1	2
MEMORY (MEGABYTE)	128	2	4
MILLION INSTRUCTIONS PER SECOND (MIPS)	36	12 SUSTAINED 20 PEAK	24 SUSTAINED 40 PEAK
SIZE (FT^3)	100	0.06	0.015
WEIGHT (LB)	10,000	3.0	0.5
POWER (WATTS)	100,000	28	66

Shown here is the computer we are going to use on Brilliant Pebbles. In the middle is a computer that will fly in the test that will take place this summer, and in the test starting in about a year from now, over on the right. I compare it again with a Cray. It has about the operating capability of a Cray computer, but of course it does not have the memory of a Cray.

FOCAL PLANE PRODUCIBILITY

MANTECH PROGRAM TO PRODUCE MERCURY CADMIUM TELLURIDE (MCT) MWIR FOCAL PLANE DETECTORS FOR BOOST PHASE SURVEILLANCE



	PRE-MANTECH	TODAY
YIELD	< 0.1%	11–30%
SENSITIVITY	1	3X
SIZE OF DETECTORS	(2 x 64)	(32 x 64 128 x 128)
UNIFORMITY (VARIABILITY)	30%	4%
PRODUCTION CAPACITY/YEAR	< 1,000	2,000,000

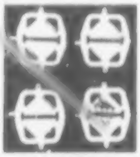
One effort that we put a lot of attention on is cost reduction efforts, in this case, on focal plane arrays. Through our manufacturing technology programs, we have been able to get the cost per pixel, as we call it, on focal plane arrays dramatically reduced. The focal plane array is the mounting or the plane on which all these very, very small and very powerful sensors are mounted to produce the kinds of images that I showed earlier.

MINIATURE INERTIAL MEASUREMENT UNIT (IMU)

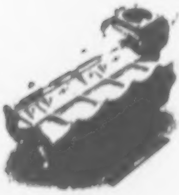
- "MICRO IMU" DEVELOPED BY SDI FOR USE IN INTERCEPTORS:
  - — UNDER EVALUATION FOR USE IN:
    - U.S. ARMY HELLFIRE MISSILE
    - U.S. ARMY NON-LINE-OF-SIGHT (NLOS) MISSILE
    - MULTINATIONAL MLRS TERMINALLY GUIDED WEAPON (TGW)
    - U.S. ARMY STABILIZED IR SEEKER (SURVIVES GUN LAUNCHED 10,000 G's)
    - U.S. ARMY TERMINALLY GUIDED SUBMUNITION
    - U.S. NAVY SHIPBOARD SATCOM STABILIZATION

There are spinoffs also from what we do. This quartz IMU sensor that I showed earlier that I have right here, the Army and the Navy are looking at it for application.

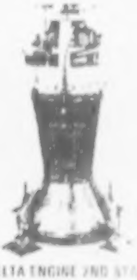
HEDI LATERAL THRUSTERS


PLATELETS

FULL SCALE TEST


HEDI

• THRUST	10,500 LB
• LENGTH	9.5 IN
• WEIGHT	11.3 LB
• THRUST TO WEIGHT	930 TO 1


DELTA ENGINE 2ND STAGE

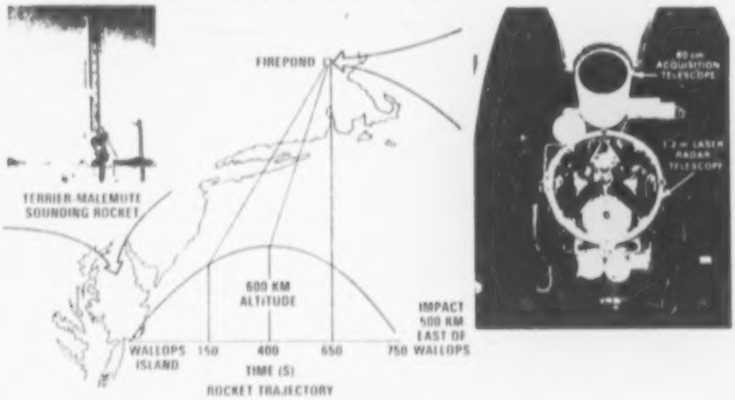
• THRUST	9,763 LB
• LENGTH	108 IN
• WEIGHT	216 LB
• THRUST TO WEIGHT	45 TO 1

It is not only in electronics that we have made great strides in miniaturization. Here is one in the propulsion arena. This is one thing that made the HEDI possible and that very successful test we had in January. Over on the right-hand side of the chart is a relatively modern engine. It is a Delta engine second stage. You can see it is about a 10,000-pound thrust engine. But it weighs about 216 pounds.

Over on the left is what we flew in January on the HEDI test. It puts out just a little more power than that Delta second stage engine, but it only weighs 11 pounds.

LASER RADAR

- CO_2 IMAGING LASER RADAR DEMONSTRATES MIDCOURSE DISCRIMINATION CAPABILITY
  - AN INFLATABLE DECOY SIMULATING AN RV WAS TRACKED AND IMAGED AT 800 KILOMETERS
  - HANDOVER AND FUSION OF SENSOR DATA DEMONSTRATED


FIREPOND
TERRIER-MALEMUTE SOUNDING ROCKET
600 KM ALTITUDE
IMPACT 500 KM EAST OF WALLOPS
WALLOPS ISLAND
150
400
650
750
TIME (S)
ROCKET TRAJECTORY
80 cm ACQUISITION TELESCOPE
1.2 m LASER RADAR TELESCOPE

We had a very successful test here about 4 or 5 weeks ago with the laser radar that we operated for the first time in a test where we launched a target off Wallops Island. Our laser radar was in Massachusetts at Firepond, and we learned that the laser radar can do imaging that is sufficient for us to be able to discriminate between reentry vehicles and decoys.

LEAP SEEKER TECHNOLOGY

CAR
HOUSE
HELICOPTER

LEAP IMAGING
INFRARED SEEKER

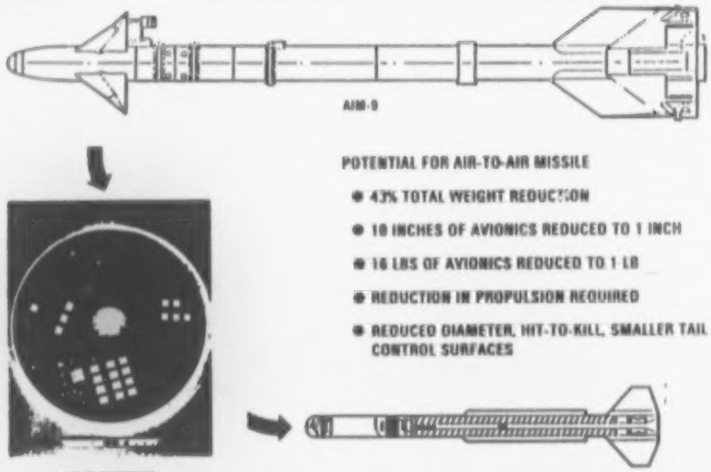
- HIGH SENSITIVITY
- HIGH RESOLUTION
- WIDE DYNAMIC RANGE

POTENTIAL
APPLICATIONS

- NIGHT VISION
  - LAW/DRUG ENFORCEMENT
- SENSOR IMAGING
  - AUTONOMOUS VEHICLE GUIDANCE
  - COLLISION AVOIDANCE
- FOREST MANAGEMENT
  - FIRE DETECTION

Another experimental effort with sensors is what we call the LEAP. And you can see there that this very powerful, very small sensor can turn out images rather than just points of light. It turns out images of the objects it is shown. Here is one of the applications of that in the next chart.

AVIONICS TECHNOLOGY SPINOFFS



POTENTIAL FOR AIR-TO-AIR MISSILE

- 43% TOTAL WEIGHT REDUCTION
- 10 INCHES OF AVIONICS REDUCED TO 1 INCH
- 16 LBS OF AVIONICS REDUCED TO 1 LB
- REDUCTION IN PROPULSION REQUIRED
- REDUCED DIAMETER, HIT-TO-KILL, SMALLER TAIL CONTROL SURFACES

LEAP AVIONICS
(HYBRID WAFER SCALE INTEGRATION)

Besides what we need it for, here is a very, very good spinoff. We think that today's AIM-9 infrared missile, our most modern one, can reduce that by a factor of about two. I have given all that information to the Navy and the Air Force to see if they want to compete with one another in trying to apply it.

Senator WILSON. Mr. Chairman.

General, could I interrupt you just for a moment.

Could you go back one slide.

General MONAHAN. Yes.

Senator WILSON. Would you care to comment just briefly on one potential application of night vision for law and drug enforcement?

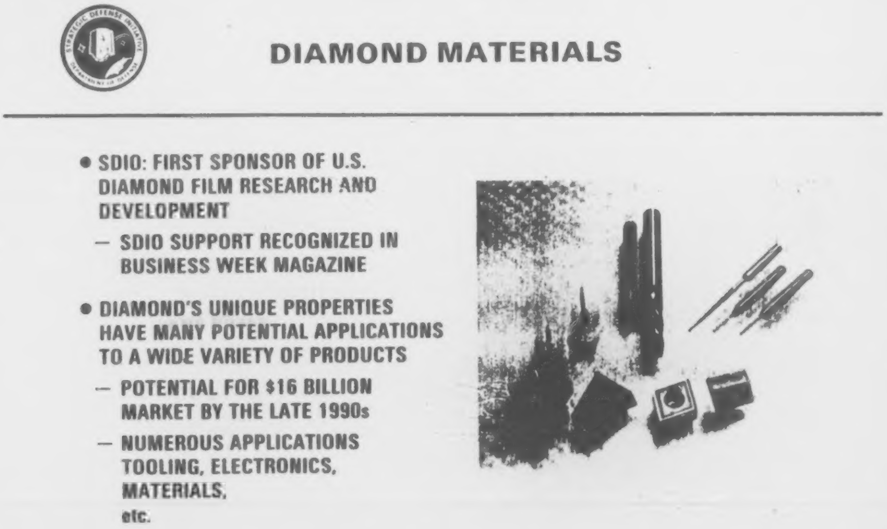
General MONAHAN. Certainly.

What this kind of sensor can do that others of that size could not do before is give you an image. In the past, for example, on the AIM-9 missile, we would get a target, but we could not get an image of the target. The resolution was not that good. That is why you could pop a flare out of an airplane and the missile might think that the flare is really the airplane, because he does not have a good image.

Now, however, the sensors and the focal planes are at the point where we can image the target. In other words, you can actually see it. You can get a picture of it. And so that is why I think it would be a good application. That is a possible application for night vision. Of course there are other night vision devices that are electro-optical, but here is one.

By the way, for example, the LANTIRN program the Air Force has uses an infrared approach also for vision at night.

Senator WILSON. Thank you, Mr. Chairman.



DIAMOND MATERIALS

- SDIO: FIRST SPONSOR OF U.S. DIAMOND FILM RESEARCH AND DEVELOPMENT
  - SDIO SUPPORT RECOGNIZED IN BUSINESS WEEK MAGAZINE
- DIAMOND'S UNIQUE PROPERTIES HAVE MANY POTENTIAL APPLICATIONS TO A WIDE VARIETY OF PRODUCTS
  - POTENTIAL FOR $16 BILLION MARKET BY THE LATE 1990s
  - NUMEROUS APPLICATIONS TOOLING, ELECTRONICS, MATERIALS, etc.

General MONAHAN. Industrial diamonds, you know diamonds have been around industry for a long, long time, so why should anyone think that there is some new invention here?

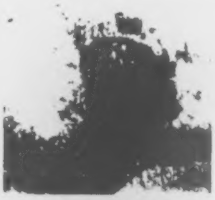
Well, there is. It is the way the diamonds are formed, a process we call chemical vapor deposition that was developed under SDIO. We use a raw material methane gas and are able to form diamonds in layers on a substrate.

Here is one example. It is a diamond window that is only one-half a micron thick or about a micron thick, about one-sixteenth the thickness of a human hair, but it can withstand one atmospheric pressure, or about 15 pounds per square inch pressure.

What is good about diamonds? Diamonds are very strong. They are very hard. They have excellent thermal conducting properties, and are an excellent electrical insulator. So, there are many, many applications. It is now starting to find some commercial application. We understand the Japanese are spending about 10 times as much as we are on this. And this is just one of the products now being produced.

One place where this can very well be used is in what we call x-ray lithography. With this diamond window, I think for the first time we will have a practical way, at low power, to accomplish x-ray lithography, which is going to allow us to even further miniaturize electrical circuits.

LASER TECHNOLOGY APPLICATION



EXCISION BY SCALPEL

EXCISION BY LASER

PULSED CO_2 LASER WITH NEW IMAGING PROCEDURES APPLIED TO THE TREATMENT OF BURNS

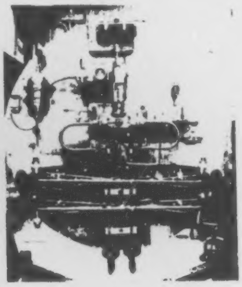
- REPLACES SURGICAL METHODS REQUIRING MULTIPLE OPERATIONS
- LARGE AREAS OF DEAD SKIN ABLATED RAPIDLY WITH GREAT PRECISION AND ACCURACY
- REDUCED SCARRING
- PROVIDES EXCELLENT BASE FOR SKIN GRAFTS

Another very interesting spinoff is in highly-pulsed lasers. Lasers have been around medicine for a long time, but not highly-pulsed lasers. Highly-pulsed lasers allow surgeons to have much greater control than they have had in the past.

One of these is work that is going on in certain medical centers. With the cooperation of the House and the Senate, we have developed a program of the medical free electron laser that we have been pursuing. This is one of the things that is coming out of it. We should be able to, the physicians tell me, greatly reduce the need for surgery on burn victims. And that will greatly speed the recovery process.

There are many other applications of those lasers, by the way, in coronary artery disease, treatment of glaucoma, and kidney stones.

GEL TECHNOLOGY SPINOFFS—CONTROLLED EJECTION



BRASSBOARD

- POTENTIAL FOR SMART EJECTION SEATS WITH APPLICATION OF PROCESSORS, GYROS AND GEL PROPELLANTS
  - — HIGH SPEED EJECTION MORE SURVIVABLE DUE TO CONTROLLED SLOW-DOWN USING THROTTLEABLE THRUSTERS
  - — AVOIDS TUMBLING
  - — CAPABILITY FOR LOW ALTITUDE/ ADVERSE POSITION EJECTION WITH CONTROLLABLE THRUST LEVELS AND DIRECTION
- FIRST COMPLETE SYSTEM TEST OF GELS (APRIL 1989)
  - — 2 MILLISECOND VALVE RESPONSE TIME
  - — FULL THRUST ACHIEVED IN 8 MILLISECONDS
  - — 247 THROTTLE PULSES IN 1.5 SECONDS

Here is one the fighter pilots ought to like. We have made a brassboard of an ejection seat that will allow pilots to bail out at very, very high air speeds, something we have never been able to do. This is possible because of the combination of fuel technology, the very small inertial measurement units that I showed you just a moment ago, and the very, very small computers.

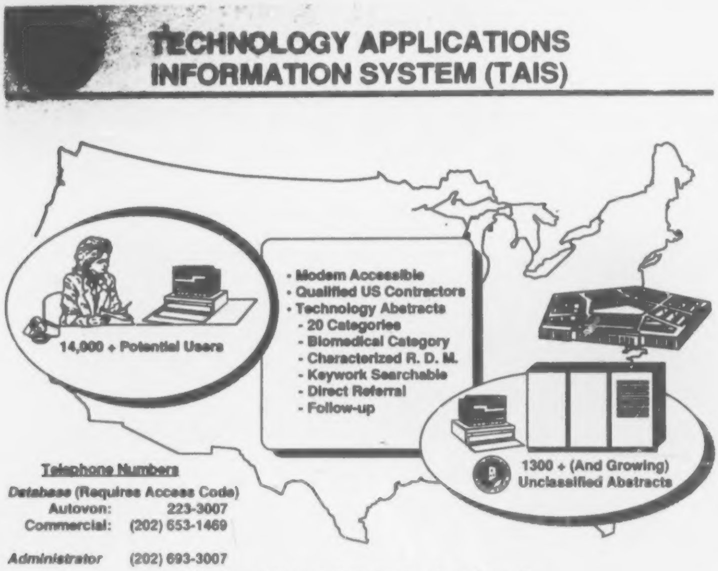
We have the brassboard, and we think this is indeed a possibility.

ADVANCED TACTICAL FIGHTER

- 301 SDIO TECHNOLOGIES IDENTIFIED BY ATF PROGRAM OFFICE
  - AREAS CURRENTLY BEING EVALUATED BY ATF CONTRACTOR TEAMS
    - —ADA PROGRAMMING
    - —ANTENNA/APERTURE
    - —E/O SYSTEMS
    - —FAULT TOLERANT DATA SYSTEMS
    - —GaAs TECHNOLOGY
    - —IR COATINGS
    - —PASSIVE DETECTION
    - —SENSOR FUSION

We also try to help other programs. For example, we have met with the Advanced Tactical Fighter Program Office, and they are looking at about 300 technology programs of ours for application in the Advanced Tactical Fighter.

We are learning from them good ways to do software. The Advanced Tactical Fighter Program has probably one of the best software development programs we have seen.



TECHNOLOGY APPLICATIONS
INFORMATION SYSTEM (TAIS)

14,000 + Potential Users

- Modem Accessible
- Qualified US Contractors
- Technology Abstracts
  - 20 Categories
  - Biomedical Category
  - Characterized R. D. M.
  - Keywork Searchable
  - Direct Referral
  - Follow-up

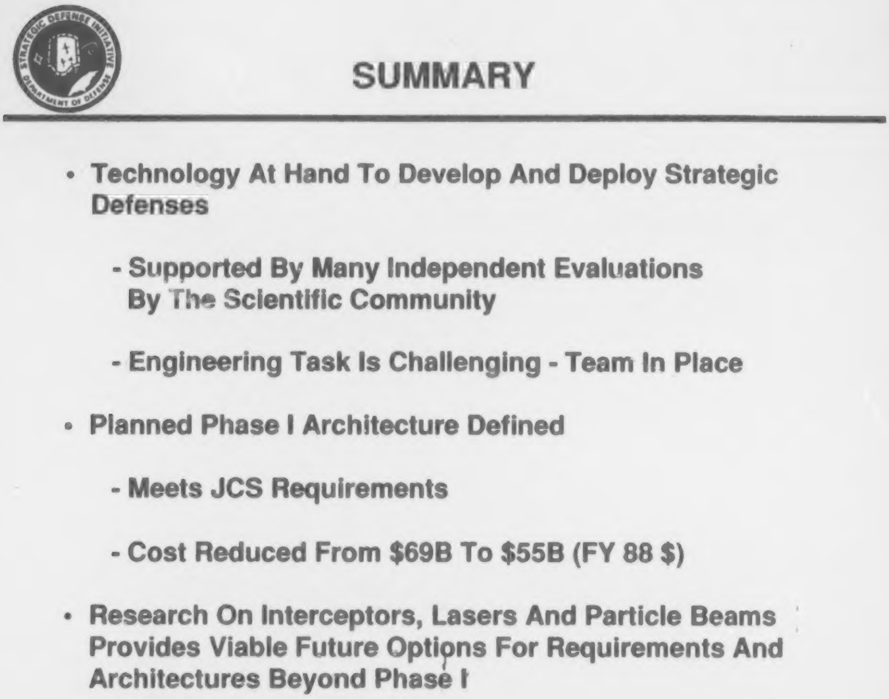
1300 + (And Growing)
Unclassified Abstracts

Telephone Numbers
Database (Requires Access Code)
Autovon: 223-3007
Commercial: (202) 653-1469

Administrator (202) 693-3007

A Systems Approach To Technology Transfer

We try to push this technology out the door. We have a Technology Applications Office within our organization that can be accessed relatively easy by calling those two phone numbers right there by people who are permitted to do so. Those are American contractors and American institutions and Department of Defense agencies, and can get access to over 1,300 abstracts, as shown.



SUMMARY

- Technology At Hand To Develop And Deploy Strategic Defenses
  - Supported By Many Independent Evaluations By The Scientific Community
  - Engineering Task Is Challenging - Team In Place
- Planned Phase I Architecture Defined
  - Meets JCS Requirements
  - Cost Reduced From $69B To $55B (FY 88 $)
- Research On Interceptors, Lasers And Particle Beams Provides Viable Future Options For Requirements And Architectures Beyond Phase I

Finally, let me just say this.

Senator WARNER. Could I interrupt to ask who is getting the patent protection and the revenue off of these collateral sales?

General MONAHAN. Well, I do not know that you would call them collateral sales, Senator Warner.

Senator WARNER. Collateral licensing, or whatever you want to call them.

General MONAHAN. That depends upon who paid for it. If the American taxpayer paid for it, there is a procedure it has to go through to ensure that we own it.

Senator WARNER. I understand that.

General MONAHAN. Each case, though, I think has to be looked at individually. In some cases, a contractor himself has put in a lot of effort. In other cases, it has been primarily with government funds. In that case, the Government owns it.

Let me just summarize briefly this way. I think that after reviews by the JASONS, the Defense Science Board, the American Institute of Aeronautics and Astronautics, and many other organizations, as well as my own people, there is not much doubt that we can do it. The technology is at hand to deploy a strategic defense system. I think that is supported by many folks and independent evaluations.

There is no question that the engineering task is going to be challenging. It will not be easy. There will be setbacks along the way. But, nevertheless, it is something we could do.

We have an architecture who we know can achieve the Joint Chiefs of Staff requirements for the first phase of a program. We are looking at that architecture very carefully today. The costs have been reduced from our estimates of $69 billion—it says $47 billion there. That is now that we no longer need the BSTS as part of the SDI structure. You can take that out, and that reduces our cost estimate.

We know what we want to do in the future, where research on interceptors, lasers, particle beams, et cetera, will give us future options to go beyond Phase I should the Nation care to do so.

I thank you very much, Mr. Chairman.

[The prepared statement of General Monahan follows:]

Statement By

Lt Gen George L. Monahan, Jr.
Director
Strategic Defense Initiative Organization

STRATEGIC DEFENSE INITIATIVE

INTRODUCTION

Mr. Chairman and Members of the Committee, I am pleased to appear before you today to speak in support of the Strategic Defense Initiative (SDI) budget request and to answer any questions you may have about the program.

The SDI program is in its sixth full year of research to determine the feasibility of effective defenses against ballistic missiles, and we continue to make excellent progress across a broad range of technologies. During FY 1989 we conducted a record number of major experiments and tests crucial to program success. We will break that record in FY 1990 and, with your support, surpass it in FY 1991 (Figure 1). The growing number of tests and experiments demonstrates that the program is moving away from paper feasibility studies, laboratory work and infrastructure development which characterized prior years. We are now moving into the testing of hardware, thus capitalizing on SDI investments. I shall discuss some of the more important program developments later in my statement.

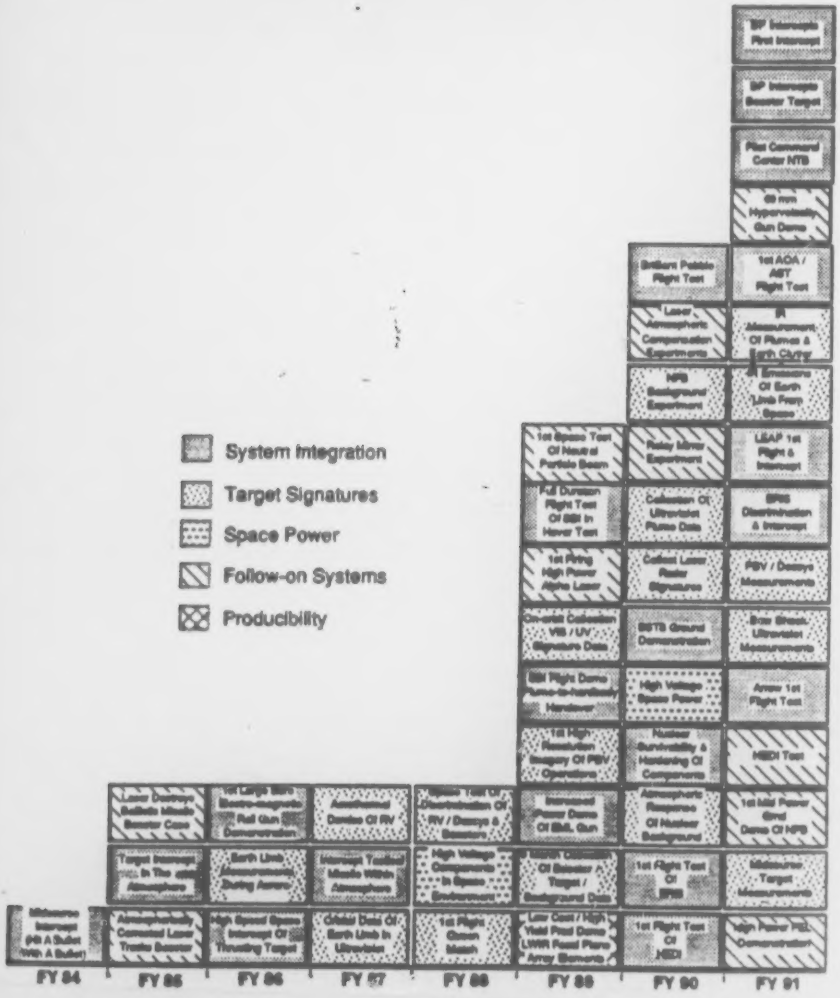
FY 1991 PROGRAM BASIS

The FY 1991 SDI budget request submitted to the Congress by the President on 29 January 1990 is structured around the following Presidential guidance:

- Provide for an informed decision on deployment within three years.
- Pursue options for layered defenses, consisting of both space and ground-based elements, which offer the promise of meeting the requirements issued by the Joint Chiefs of Staff (JCS) for Phase I defenses.
- Expedite research and development of promising defense concepts (such as Brilliant Pebbles) that could intercept missiles during the boost portions of their flight. Pursue other Phase I space-based system components as a back up.
- Conduct the program in full compliance with all U.S. international obligations, including the Anti Ballistic Missile (ABM) Treaty.

- Structure the program to permit deployment of layered defenses on a schedule as close as possible to that envisioned in the FY 1990-1994 Five Year Defense Plan submitted to the Congress on January 9, 1989.

FIGURE 1
MAJOR TECHNICAL ACCOMPLISHMENTS



I would like to take a few minutes to discuss each of these five points in some detail.

PROVIDE FOR AN INFORMED DECISION ON DEPLOYMENT

To support this decision, the FY 1991 SDI program is structured to continue research and development on a broad range of maturing and advanced technologies. Research to demonstrate and validate elements of the Phase I system is balanced with tests and experiments for follow-on concepts such as directed energy technologies. The program is focused on reducing technical risk in areas such as target signatures against a variety of backgrounds, communications, radiation hardening, space power, and system integration. The program is also focused on reducing costs in areas such as optics, focal plane arrays, light weight materials, and launch. The overall approach is intended to provide the decision makers with information on initial defenses and options for future capabilities to enhance initial defenses should this prove necessary.

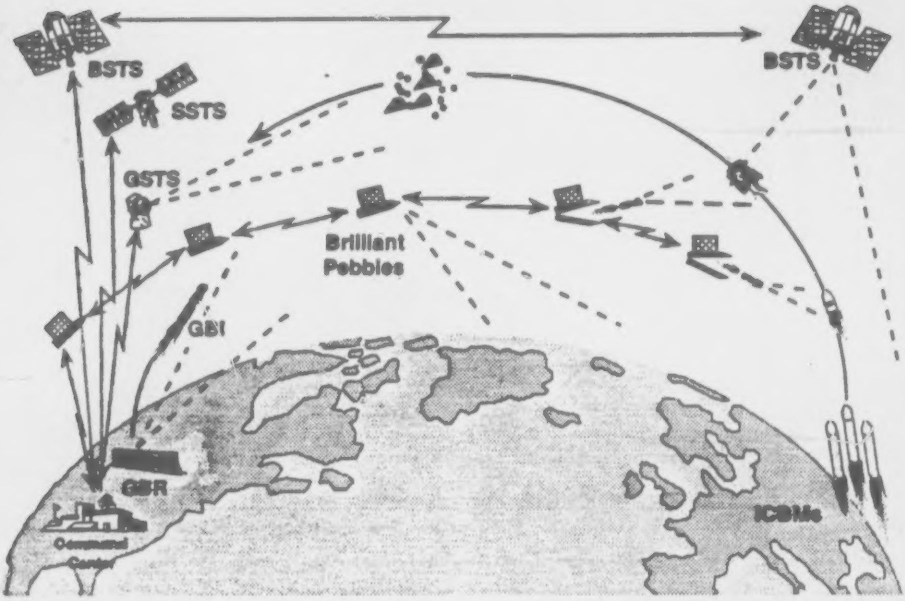
LAYERED DEFENSES TO MEET JCS REQUIREMENTS

The Phase I system has been designed to serve as the first in a potential series of deployments leading to a more balanced deterrent posture based on offensive and defensive forces. With this understanding, the JCS issued in 1987 a formal statement of mission objectives and required system characteristics for Phase I. These requirements provide guidance for establishing the architecture explained in prior budget requests and depicted in Figure 2.

The architecture selected is consistent with the findings and recommendations of the 1984 Fletcher Study on SDI, and subsequent studies have confirmed that it is a sound approach. It is a two-layer system consisting of both ground and spaced-based interceptors and sensors and their supporting systems.

I would also like to review for the Committee the rationale for pursuing layered defenses. As you know, layered defenses are those which engage attacking missiles in more than one portion of their trajectories. The significant benefit to layered defenses is that they are highly effective against a variety of attacks and are less vulnerable to possible countermeasures. The FY 1991 SDI program is consistent with this rationale. First, our research is aimed at space-based kinetic and directed energy weapons and sensors for the high payoff, boost/post boost region where a single hit by a defensive weapon could destroy multiple attacking warheads and their decoys. Second, we are examining ground and space-based kinetic and directed energy weapons and sensors to detect and destroy warheads during their relatively long flights in the midcourse region. Additionally, we will explore ways to destroy warheads as they reenter the atmosphere in the terminal region.

Figure 2
SDS PHASE ONE ARCHITECTURE



EXPEDITE RESEARCH OF PROMISING CONCEPTS (BRILLIANT PEBBLES)

The Brilliant Pebbles concept consists of a light-weight, low-cost, single hit-to-kill kinetic kill vehicle that provides integrated sensors, guidance, control, and battle management. During FY 1989, this autonomous, highly survivable, space-based defensive interceptor concept was independently reviewed by a Department of Defense Space-Based Architecture Study Group, by the distinguished JASONS panel of scientists, and by the Defense Science Board. The concept was found to be innovative and capable, with no fundamental flaws, and deserving of continued support. Initial cost estimates show that Brilliant Pebbles could reduce the cost of a Phase I system by at least 20% (Figure 3). I believe that these estimates are conservative, especially in light of the opportunities for innovation in manufacturing technology for producing large numbers of identical Pebbles. I also believe that the strategy we have selected for developing this concept will take advantage of these opportunities.

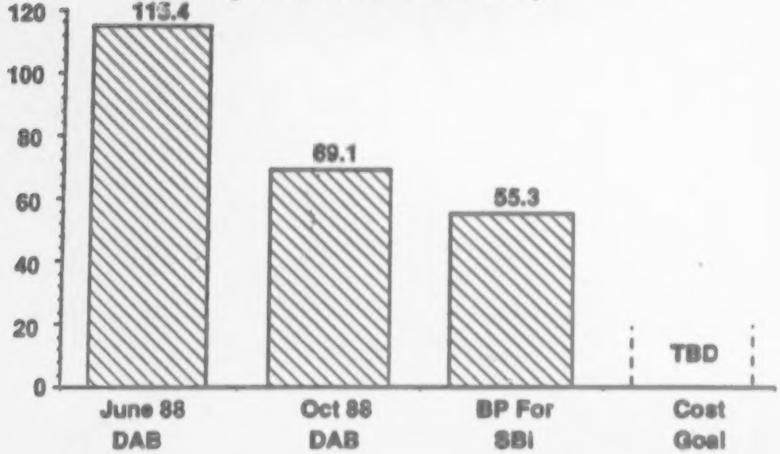


Figure 3
SDS PHASE I COST COMPARISONS
(FY 88 $ IN BILLIONS)

We launched in FY 1990 a multiple-contractor competition for concept definition. My office, with the cooperation of the Lawrence Livermore National Laboratory, will manage this highly streamlined program. The program is designed to bring industry on board and at the same time maintain the simplicity and low-cost features of the concept. A follow-on design competition will be initiated in FY 1991. To obtain maximum benefit from contractor innovation, we are not imposing military specifications or standards. Requests for proposals and contracts will state requirements in a simple fashion, and contractor reporting requirements will be minimized.

Additionally, given Brilliant Pebbles potential for independent operation, the role of the Boost Surveillance and Tracking System and the Space Surveillance and Tracking System in the Phase I architecture is being reassessed. Although these sensors are definitely needed for non-SDI missions, the Phase I architecture with Brilliant Pebbles may not require these sensors or may require less capability from them. This outcome could further reduce the cost of a Phase I system.

In line with Presidential guidance and Defense Science Board recommendations, we will continue research and development on more conventional space-based interceptor concepts.

TREATY COMPLIANCE

The Department of Defense has in place an effective compliance process under which the Undersecretary of Defense for Acquisition, in consultation with the Department's General Counsel, Undersecretary of Defense for Policy, and Chairman JCS, ensures that all defense programs are in compliance with all U.S. strategic arms control obligations. SDI experiments, tests, and other research and development efforts proposed for FY 1991 will, prior to execution, be carefully screened by the Department's Compliance Review Group to certify that planned activities fully comply with the ABM Treaty. This compliance process has been followed in all previous years of the SDI program. Additionally, I, as the

Director of the SDI program, am required to certify continued compliance quarterly and have established internal procedures to do so.

ATTEMPT TO MAINTAIN JANUARY 1989 PLANNED SCHEDULE

Planned funding for the SDI program for FY 1990 through FY 1994 was reduced substantially after January 1989. The President understood that this could adversely impact our ability to maintain the pace of the program. Yet, he asked that we try. I am pleased to report to this Committee that we have, to a large extent, been successful. We did this by making things simpler and cheaper. Incorporation of advances in technology, the inclusion of Brilliant Pebbles in the space-based segment of the Phase I architecture, and judicious use of available resources has, so far, allowed us to maintain the program balance and pace needed to support a decision on deployment and to maintain an option for initial deployment in this decade. Our ability to continue on this path clearly depends on the level of funding for FY 1991 and beyond.

SDI PROGRAM PROGRESS

When SDI was initiated, this nation's experience with ABM systems was limited primarily to 9 months of operation in the 1970s of the Safeguard ABM system at Grand Forks, North Dakota. The Safeguard system employed nuclear-tipped missiles and large ground-based radars. Because of technology limitations in areas such as computer guidance, sensors, optics, and miniaturization, we could then not achieve the accuracy needed to realize direct hit-to-kill, which eliminates the need for a warhead of any kind. We also knew there were important issues with system survivability and battle management. When Safeguard was abandoned, few predicted the large and rapid advances in technology that have permitted ballistic missile defenses to re-enter our national security equation.

Times Have Changed

- In 1984 we hit a "bullet with a non-nuclear bullet" using a ground-based interceptor and on-board passive infrared sensor for terminal guidance to destroy a simulated reentry vehicle launched from a ballistic missile.
- In 1986 we validated guidance laws in space by destroying a thrusting target. This simulated an intercept in the boost portion of a ballistic missile's trajectory.
- In 1987 the Flexible Lightweight Agile Guided Experiment demonstrated that a reentry vehicle could be intercepted in the atmosphere using a radar-guided interceptor.
- In January of 1990 the first High Endoatmospheric Defense Interceptor flight test demonstrated our ability to effectively cool a terminal interceptor's forebody and sensor window. This is a crucial step toward demonstrating that the sensors will not be disabled by heat from atmospheric friction. Until this flight test, many in the technical community believed that effective window cooling could not be achieved.

To intercept a missile or reentry vehicle, defenses first must detect, discriminate, acquire, and track the targets under a variety of conditions. Early in SDI we established, and we continue to operate, a broad-based program to collect target signatures. This program includes numerous sounding rockets and rocket-launched satellites to put up sensors to view targets and decoys against different earth and space backgrounds. It also includes various airborne, shipborne, and ground-based sensors to collect signature data. (Examples of airborne platforms are an NC-135A equipped with sensors that operate in the visible through long wavelength infrared bands and a Lear jet equipped with ultraviolet through medium wavelength infrared sensors.) Further, we have an aggressive program to explore and develop passive, active, and interactive discrimination technology. This program is supported by activities which build and test various decoys and penetration aids to see what will "stress" the system. Some specifics will illustrate our accomplishments in these areas.

- Throughout the 1980s our Delta 180 series detected, acquired, and tracked numerous targets including boosters, reentry vehicles, and decoys.

- In 1988 we collected our first infrared data on foreign targets in the QUEEN MATCH flight, and conducted many sounding rocket tests to evaluate decoys, countermeasures, and the effectiveness of discrimination.

- In 1989, in the JANUS experiment, we used high resolution infrared imagery to collect target signatures of post-boost vehicles.

- Also in 1989, with our space-based interceptor hover test, we integrated a host of technologies and demonstrated the full capability to acquire and track a rocket plume, then transition to tracking the rocket hard body. This capability is absolutely essential for boost and post-boost intercepts.

- In 1990 we will demonstrate that we can detect boosting targets of all intensities of interest against a variety of earth backgrounds.

Much progress has also been made in ensuring that defenses can be integrated and managed, always with man-in-the-loop, and that they are survivable.

- The National Test Bed has been established to develop, test and validate strategic defense concepts and software.

- We are building high-fidelity end-to-end simulations that allow defense concepts to be tested against a variety of realistic threat models. This effort provides early user involvement in the development of command and control concepts.

- An early version of a command center was successfully demonstrated at the Army Research Center. This program showed that, with man-in-the-loop, there is sufficient time to assess, react and engage attacking missiles throughout the battlespace.

- We have established a software center of excellence to address the large scale integration of software for a defensive system.
- To ensure that systems can operate reliably in the adverse environments caused by nuclear weapon detonation, we validate the survivability of system components, such as electronics, optics and structures, through experiments on underground nuclear tests.
- Red/Blue team analyses are conducted to examine the ways in which an attacker may try to defeat the defenses, and to establish effective measures to offset those attempts. Results are then fed back into efforts to design both the system and its operational concepts.

Most of the progress discussed so far relates to Phase I. However, progress in advanced technologies, such as directed energy, has also been impressive. The key issues being examined are target acquisition, pointing and tracking, generation of high power lasers and particle beams, and beam lethality.

- In 1985 we demonstrated at low power the capability to both track a rocket in space and to propagate a laser beam through the atmosphere without significant distortion. In several other experiments, we proved lasers are lethal weapons for destroying both solid and liquid propellant missiles.
- In 1986 our first particle beam experiment irradiated a miniature reentry vehicle with a high intensity proton beam. The results indicated that the explosives contained in a reentry vehicle are detonated by such beams.
- Early in the program many experts had stated that building large optics would be impossible and prohibitively expensive. In 1988 we built a high quality mirror, the first large diameter segmented mirror with a surface that is controlled electronically. That mirror will be integrated into a ground test in 1991.
- In 1989 the Alpha Chemical laser for the first time produced a high-power beam when fired in its ground test facility. This milestone in the space-based, chemical laser program is being used to validate the technology, computational methods, and fabrication processes necessary for scaling chemical lasers, configured for space basing, to power levels required for a strategic defense.
- In 1989 our Beam Experiment Aboard Rocket conducted the first test in space of a neutral particle beam. It employed a relatively light-weight power supply which can be packaged for space operation. It demonstrated that complex directed energy weapons could be reliably operated in space.
- In February of 1990 we launched the first long-term directed energy space experiments from Cape Canaveral. The 2-1/2 year Low-Power Atmospheric Compensation Experiment, known as LACE, will measure the atmospheric distorting effects on laser beams. The 1 year Relay Mirror Experiment, known as

RME, will demonstrate the relay element of a ground-based laser.

- The Talon-Gold ground test demonstrated our ability to place a beam on target very accurately The next challenge is to do it in space, an experiment currently planned for 1992. The precision we are demonstrating in these experiments is equivalent to firing a laser from high above the Empire State building to hit a volleyball on a California beach.

Our research into defense systems has also yielded tremendous technical progress in areas such as miniaturization, reduced manufacturing cost, and light weight structures.

- Efforts in navigation technology have ushered in a whole new class of miniaturized inertial measurement units for navigation and guidance in the 1990s. Bulky units that weighed tens of pounds in the past will weigh only ounces in the future, with costs reduced by a factor of ten.

- We are learning how to manufacture large quantities of infrared detector elements, known as pixels, at greatly reduced costs. Prior to SDI, the costs of such pixels were in the range of hundreds of dollars each. Today we are looking at a range of a few dollars to a fraction of a dollar.

- Our work on making stiff, high-performance trusses and tubes from advanced composite materials provides one example of developing lightweight, high strength structures for space platforms.

These and other advances have been exploited to reduce the costs and enhance the performance of prospective strategic defense systems.

Additionally, our research has yielded a wealth of spin-off applications of SDI technology.

- An outgrowth of our free electron laser program is medical use of lasers to remove burn and scar tissue, break up kidney stones, and treat heart disease and cancer.

- Some of our laser work also contributed to a blood bank purification process that cleanses donor blood bank supplies of infectious viruses.

- SDI-developed carbon material for use in orthotic braces will double the strength and reduce the weight by two-thirds when compared to conventional steel braces.

- Our work on optical technologies could lead to a new generation of very high speed, low cost supercomputers.

- SDI neutral particle beam technology may have applications in areas such as airport detection of explosives, cancer therapy, and non-destructive inspection of manufactured items such as rocket motor components.

- SDI research is creating commercial opportunities in superconductivity, diamond crystal coatings, communications, industrial manufacturing processes, electronics, and microwave technology.

- SDI hypervelocity gun technology may be utilized for mass transfer of materials from the lunar surface to low earth orbit.

- The National Aeronautics and Space Administration's Space Station and National Aerospace Plane should benefit from SDI advances in computing, signal processing, and light weight structures.

- SDI technology may have other defense uses such as reducing the weight and cost of air-to-air missiles. Hypervelocity gun and directed energy technology could also be used in the theater battlefield.

As you can see, Mr. Chairman, SDI technical progress during the 1980s has been very impressive across a broad range of technologies.

FY 1991 BUDGET AND PROGRAM HIGHLIGHTS

I will turn now to the highlights of our FY 1991 budget and program. The Fiscal Year 1991 budget request for the SDI program is $4.47 billion. Although this is an increase of $870 million over the FY 1990 appropriation, it is a $1.0 billion reduction from the FY 1991 budget included in the FY 1990/1991 budget request last year. Our major technical plans are discussed next.

Development of the Boost Surveillance and Tracking System (BSTS) missile launch warning satellite is on track. The system is scheduled to enter full-scale engineering development in FY 1991, subject to a successful ground demonstration in FY 1990. BSTS is essential to the national mission of tactical warning/attack assessment and other missions. However, its role as a critical node to strategic defense has diminished with the adoption of Brilliant Pebbles. The first launch of a full-scale development vehicle is planned for the mid-1990s.

The BSTS program was created prior to SDI to resolve long standing deficiencies in the Defense Support Program (DSP). As the follow-on to DSP, BSTS is necessary in order to satisfy validated TW / AA requirements. BSTS satisfies concerns in areas of survivability (of satellites and ground assets), decentralization of tactical information (through direct reporting to users), assured worldwide coverage and more warning time (through increased sensitivity and quicker reporting times). Application in BSTS of today's state-of-the-art technology frees the early warning system from overseas bases, requires fewer personnel to operate, provides more detailed information to using commanders, and has a lower life-cycle cost. BSTS will complete its demonstration and validation phase next year. The program, fully ABM Treaty compliant, is ready to enter FSD to fulfill the TW / AA mission. Concurrently, BSTS is structured to protect a decision for possible future use within strategic defenses. Delaying start of FSD continues identified TW / AA shortfalls (through delayed transition from DSP), adds costs (both in the form of increased overall BSTS program costs and additional DSP satellite and continued multiple ground station costs), and jeopardizes our investment (approx $1B to date) and the industry base currently in place to carry development forward. Finally, delay in the start of FSD in 91 will bring us back to this table next year with the same issues but with no additional information; only higher costs.

The High Endoatmospheric Defense Interceptor is the most advanced concept being considered for terminal defense. It is a ground-based, hypervelocity, high acceleration interceptor designed to destroy ballistic missile reentry vehicles high in the atmosphere. It is both a potential follow-on to Phase I and a back up to the Ground-Based Interceptor. The High Endoatmospheric Defense Interceptor also has strong potential for theater defense. During the remainder of FY 1990 and in FY 1991 we will prepare to conduct a second flight test to verify target acquisition and tracking functions, control and guidance systems, and seeker window survivability.

In FY 1991 we will also continue construction of the technical facilities for the Free Electron Laser Accelerator, Wiggler, and Beam Control System at White Sands Missile Range in New Mexico. When completed (in approximately FY 1993), it will be available to house the high power laser required to conduct the technology integration experiments needed to validate the concept.

As I mentioned previously, during FY 1991 we plan to conduct a record number of major tests and experiments (16). These will encompass a broad range of technologies, and they include:

- The first intercept by a Brilliant Pebbles experimental vehicle;
- Major phenomenology experiments to collect vital signature and environmental data in support of the target acquisition, tracking, and discrimination functions;
- A pulsed high power concept demonstration of a free electron laser device;
- A full power test of the neutral particle beam ground test accelerator at Los Alamos; and
- The first flight tests of the Arrow theater defense experimental interceptor. Arrow is a good example of an allied cooperative program.

THEATER DEFENSE AND OUR ALLIES

Mr Chairman, before concluding, there are two other important topics related to the SDI program that I would like to address. These topics are theater defense and the participation of our allies in the SDI program.

The SDI charter reflects a concern for both U.S. and Allied security and stresses development of defensive technologies for ballistic missile threats of all ranges. The FY 1991 program would continue our theater defense program that includes examination of architecture studies, technology demonstrations, tests, and the development of test beds to explore alternatives which could provide a defense against theater-class ballistic missiles. Allied participation has enhanced our understanding of theater defense problems.

In fact, Allied participation in theater defense and other SDI research has proven beneficial to both the SDI program and to our Allies. We have also recently signed several cost-sharing, project-specific cooperative research commitments with the Allies. Allied participation contributes to the attainment of SDI objectives, and we will continue to cooperate with our Allies on many aspects of the SDI research program.

CONCLUSION

In conclusion Mr. Chairman, I believe that the most significant evidence of progress during the six year history of the SDI program is that we now have:

> A Phase I architecture that will meet the requirements for strategic defense, based on technically achievable sensors, command and control capability, and interceptors;
>
> Reasonable cost projections for such a system;
>
> A set of technology development projects that support Phase I as well as follow-on systems that could employ advanced concepts such as lasers and neutral particle beams; and
>
> A national strategic defense research and development infrastructure, staffed with extremely talented and dedicated professionals, that stands ready to resolve the remaining technical and engineering issues of strategic defenses.

A team of experts from the prestigious American Institute of Aeronautics and Astronautics Society spent a year looking at our program. This was the first group to review our entire program, including Phase I, follow-on systems, and our technology efforts. They said, "no fundamental obstacles were found." Deployment of a Phase I system depends on the resolution of technical issues currently being addressed. The engineering task remaining is challenging, but it can be accomplished.

SDI research is an excellent investment. That is why, in an era of scarce defense resources, the President is so supportive of the program. We continue to show impressive results. You can be assured that significant technological advances which occur in the future will be exploited to further reduce the cost and improve the performance of a prospective strategic defense system. Our past record amply supports this commitment.

Mr. Chairman, I believe that in the first six years of the SDI program we have demonstrated that our capability to develop and deploy effective defenses is constrained not by our ability to overcome technical hurdles, but by the funding we receive. I therefore urge you and the Members of the Committee to support our full budget request. With your backing, we can continue a balanced and vigorous program of research and development leading to deployment of strategic defenses for our nation.

I will be happy to answer any questions you may have.

Senator **Exon**. General, thank you very much.

If we can bring the lights back up now. That was an interesting presentation. Thank you very much.

The first question I have is with regard to this $55 billion figure. Did you not specify that was in 1988 dollars?

General **Monahan**. Yes, that is in 1988 dollars.

Senator **Exon**. Now what would that be in the then-dollars, by the end of the decade?

General **Monahan**. Well, if we apply the current Department of Defense projections of inflation, it came out to I believe about $69 billion, if I am not mistaken.

Senator **Exon**. $69 billion.

General **Monahan**. But to try and predict inflation is very difficult.

Senator **Exon**. The next three questions I have I hope maybe can put to rest for this session of the Congress some very difficult problems that we have had with the administration on this matter of deployment and living up to the treaties in existence. I am going to phrase these questions and direct them to you, Dr. Herzfeld, in hopes that these are answered clearly.

Let me first ask you, Dr. Herzfeld, Appendix C of the 1990 Strategic Defense Initiative Organization, or SDIO, Report, which was submitted to the Congress by the Secretary on June 7, 1990, contains the following unclassified statement, and I quote, "Currently, no experiment has been approved which would not fall within the categories used in Appendix D of the 1987 report to Congress on the SDI."

Dr. Herzfeld, can you confirm to the subcommittee that this statement means that there are no SDI development or testing activities planned in fiscal year 1991, including long-lead acquisition in fiscal year 1991 for material or equipment uniquely required for such development or testing in later years, which would conflict with the agreement on the ABM compliance issue which the Congress worked out with then-National Security Advisor Frank Carlucci in 1987, as reflected in section 225 P.L. 100-180, or commonly referred to as the Levin-Nunn Agreement?

Dr. **Herzfeld**. Mr. Chairman, yes, I can. As a matter of fact, the SDI program we are proposing for fiscal year 1991 includes no experiments or tests in fiscal year 1991 that would go beyond what is called the restrictive interpretation of the ABM Treaty, nor does it include funds to purchase equipment in fiscal year 1991 that would be uniquely required in later years for such experiments or tests. Should our plans in this regard change, we would consult with the Congress and request your approval through normal budgetary procedures.

Senator **Exon**. Thank you.

Now question number two. Dr. Herzfeld, can you also confirm that none of the SDI experiments which require additional compliance review, including future orbital tests for Brilliant Pebbles, will entail development or testing in fiscal year 1991, or the purchase in fiscal year 1991, of material or equipment uniquely required for the development or testing in later years that would conflict with the 1987 agreement as reflected in section 225 of P.L. 100-180?

Dr. **Herzfeld**. Mr. Chairman, yes, I can, but with one important qualification. We have not yet completed the compliance review process on Brilliant Pebbles tests 9 through 12, which are scheduled to occur in late fiscal year 1991 and 1992. If we conclude that it is necessary, for programmatic reasons, to go beyond the so-called restrictive interpretation in these tests, we would consult with the Congress and request the approval to do so through normal budgetary procedures.

In the interim, we will not purchase equipment for these tests which would be uniquely required for tests that go beyond the so-called narrow interpretation. While much of this happened before I joined the Department, I believe it is fully consistent with the agreement that was reached in 1987.

Senator **Exon**. Thank you, Doctor.

My last question along this line is a very short one, and I hope that the answer is what we expect. Dr. Herzfeld, is the 1985 Presidential Directive requiring that the SDI program be conducted according to the so-called restrictive interpretation still in effect?

Dr. **Herzfeld**. Yes, Mr. Chairman, that directive still applies. We wish to avoid a divisive debate on the interpretation of the ABM Treaty. It is our policy to identify and implement the best technical program for SDI, consistent with U.S. obligations under the ABM Treaty. If the program raises questions with regard to the so-called broad interpretation of the treaty, we will address these questions with the Congress at that time, on the basis of the merits of the specific programs we have proposed.

Senator **Exon**. Thank you, Dr. Herzfeld. My time is up on the first round. And I am pleased to recognize Senator Thurmond.

Senator **Thurmond**. Thank you, Mr. Chairman.

Mr. Chairman, before I begin my questions, I ask unanimous consent to include in the record an article by the distinguished ranking member of the Senate Armed Services Committee, Senator John Warner. The excellent article entitled, "We Still Need Missile Defenses," is most appropriate for this hearing.

I ask that it be put in the record.

Senator **Exon**. That will be put in the record, without objection.

[The information follows:]

The New York Times

Founded in 1851

ADOLPH S. OCHS, Publisher 1896-1935
ARTHUR HAYS SULZBERGER, Publisher 1935-1961
ORVIL E. DRYFOOS, Publisher 1961-1963

THE NEW YORK TIMES, MONDAY, JUNE 18, 1990

We Still Need Missile Defenses

By John Warner

WASHINGTON

Have the dramatic changes in Eastern Europe and the Soviet Union undermined the need for continued research on ballistic missile defenses? Absolutely not. If anything, the case for some type of missile defenses is more compelling today than at any time since the advent of nuclear weapons and ballistic missiles.

We must remain prepared to deal with political and military instability. The Soviet Union is increasingly fraught with nationalist and ethnic unrest, and its economy cannot fulfill the basic needs of the people. Mr. Gorbachev's viability is questioned because of the seemingly indomitable problems facing his nation.

The Soviet Union still possesses a formidable military capability. Most notable is its strategic offensive and defensive nuclear force modernization program. Soviet ballistic missile defenses around Moscow — the world's only such system — are being upgraded.

Consequently, our nuclear deterrent must remain, in both perception and reality, uncontestable to any foreign power. And we must consider the enormous benefits of a strategic missile defense.

Even as arms control negotiations move toward reducing the overall levels of strategic delivery systems, our existing strategic defenses — such as air defenses, early-warning and surveillance and intelligence — are clearly seen by other countries as stabilizing and unthreatening. Missile defenses will enhance this stability by assuring that our perhaps more vulnerable retaliatory forces are protected and by denying an attacker any certainty of achieving his objectives.

They also provide a hedge against cheating on arms control treaties. Indeed, effective missile defenses actually promote strategic arms control objectives by reducing the military value of multiple-warhead missiles. They also provide incentives for the Soviet Union to move to a less threatening force of single-warhead, land-based missiles.

The strategic threats are multiplying.

In addition, there are many countries that now possess missiles that threaten the interests of the U.S. and its friends. Many of these missiles are capable of reaching allies like Israel and can be equipped with chemical or biological warheads, and soon even nuclear weapons.

Today, the number of developing countries possessing ballistic missiles with a range of less than 1,000 miles — such as Iraq and Syria — has increased substantially. William Webster, Director of the Central Intelligence Agency, recently informed Congress that, by the year 2000, at least six third-world countries will have ballistic missiles with ranges of up to 1,800 miles, and three of them may develop ballistic missiles with a range of 3,400 miles.

Missile defenses in the U.S. and within the borders of our allies would greatly deter long-range ballistic missile use. Tactical ballistic missile defenses deployed by our allies would enhance deterrence and stability.

On a recent trip to California, I had a firsthand look at the Strategic Defense Initiative. The question is no longer whether the country has the technical ability to build cost-effective missile defenses; it is clear we do. Rather, we must now ask what role missile defenses will have in our national strategy.

As in the air defense debate in England during the 1930's, we must now ask: Does America want to be defended, and if so, with what systems? For England, the outcome of that debate was pivotal. It was England's advanced air defense systems that saved it in the summer of 1940.

It is worth remembering the words of Winston Churchill at the peak of the air defense debate: "I think it would be a great mistake to neglect the scientific side of purely defensive action against aircraft attack. Certainly, nothing is more necessary, not only to this country, but to all peace-loving . . . powers in the world . . . than that the good old earth should acquire some means of destroying the sky marauder."

Today, the marauder is ballistic missiles. I am convinced that we must now, more than ever before, plan for the inclusion of missile defenses in our national security strategy. □

John Warner, Republican of Virginia, is a member of the Senate Armed Services Committee.

Senator **Thurmond**. General Monahan, during testimony before the House Armed Services Committee on April 4, you indicated that BSTS was no longer needed for the Phase I architecture, yet you include BSTS as part of the Phase I architecture in figure two of your testimony today.

What is the status of BSTS? And if BSTS is only needed for TWAA requirements, when will SDIO transfer the program to the Air Force?

General **Monahan**. Senator, the BSTS program is needed now, I think, for a very important national mission that we call tactical warning and attack assessment. We do not need it any longer for battle management and command and control now that we have adopted Brilliant Pebbles. So we do not have that association there with SDI, the very critical association that it had in the past.

But, as I said, we still need it for the tactical warning and attack assessment role. That is the role now being played by other satellites, what are called the Defense Support Program satellites, that have a number of deficiencies, and deficiencies which, by the way, include overseas ground stations, because the data processing has to be done on the ground.

The BSTS program was begun before SDI, a few years before. It was called, I think, advanced warning satellite back in those days. It was put into the SDI program in 1984 because the technology needed under BSTS was very similar to other technology within SDI, and we thought back in those days that it would be a critical element. But now that we have adopted Brilliant Pebbles, it is not.

Eventually it will go back to the Air Force. That is a matter of time. I do not know what is exactly the best timing for that. The production funds, for example, for BSTS are in the Air Force budget and always have been. Most of the full-scale development funds are in SDI. All of the pre-full-scale development and demonstration/validation funds were in SDI. And some of the FSD funds are also in the Air Force.

So there is an appropriate time, and we have not really established just exactly when that is at this time.

Senator **Thurmond**. General Monahan, if BSTS is transferred to the Air Force to fulfill only TWAA requirements, how much of SDI's projected 6-year funding will be shifted along with the program?

General **Monahan**. I believe it is in the vicinity of about $5.5 billion, Senator. For example, in fiscal year 1991, there is $265 million for full-scale development, and $137 million to complete what we call the demonstration/validation phase. That is a little over $400 million in that one particular year. But if I add it all up, and I did a couple of weeks ago, it comes to right around, I think, $5.5 billion.

Senator **Thurmond**. If you do not have any of these figures, you can put them in the record.

General **Monahan**. I certainly can do so, Senator.

[The information follows:]

The SDI FSD funds to fulfill only TW/AA requirements that could be shifted along with a transfer of the program to the Air Force are:

Fiscal year 1991, $265 million; fiscal year 1992–1997, $4,876 million (Six Year Funding); total $5,141 million.

Senator **Thurmond**. How much does the Air Force intend to provide the program in the Six-Year Defense Plan beyond what SDI may transfer?

General **Monahan**. I do not know what their precise numbers are.

Senator **Thurmond**. Let us put it in the record then.

General **Monahan**. I will put it in the record, yes.

[The information follows:]

BSTS BUDGET

	90	91	92	93	94	95	96	97
SDIO	300	402	464	621	965	1,390	1,179	528
AF			99	273	370	798	1,282	1,072
	300	402	563	894	1,335	2,188	2,461	1,600

Senator **Thurmond**. Put differently, what assurances do we have that the Air Force will continue to fully fund BSTS in the future?

General **Monahan**. Well, when it goes to the Air Force, as I have said, they have already put it into their budget. Now I personally cannot speak for them in that regard. But I do know that they have budgeted for it.

Senator **Thurmond**. General Monahan, how much savings will there be in the projected cost of the BSTS program with removal of the battle management function?

General **Monahan**. Well, that is very, very difficult to say, also, Senator.

Senator **Thurmond**. Supply it for the record, if you would rather do that.

General **Monahan**. Yes, indeed.

[The information follows:]

Of the roughly $8.8 billion (fiscal year 1988 $) for BSTS acquisition, approximately $.2 billion are attributable to unique BMD features. Of these, 25–30 percent ($50–$60 million) could be directly associated with the battle management function.

FY 90-91 PROGRAM CHANGES

($ In Millions)

	FY 90	FY 91
Phase I	1688.0	2350.6
Follow-on	840.2	984.4
Key Technologies	284.7	337.1
Operational Support / Mgmt	261.4	239.7
Test & Evaluation	189.5	217.3
Theater Defense	124.7	131.8
IS&T / SBIR	113.4	116.8
Engineering Analysis	102.9	93.7
Total	$3604.8	$4471.4

Includes MILCON

General MONAHAN. But until we really select a contractor and can understand the contractor's designs, that is going to be difficult to sort out.

Senator THURMOND. General Monahan, since the BSTS program is undergoing a possible change in program control and mission, some have suggested that we should slow the decision of FSD by not funding that portion of the program this year. You briefly addressed this issue directly in your testimony. Can you expand upon the point and talk about the problems or benefits associated with not funding FSD this year?

General MONAHAN. Yes, sir.

Senator THURMOND. And make it brief.

General MONAHAN. I would be very happy to do so, Senator.

There are three major reasons for doing so. One is the military reason, and a very important military reason. We have some deficiencies with those DSP satellites that are up there doing their job today. Those things have to be fixed. There are some vulnerabilities associated with them. So on the military side there are some major reasons for doing it: better sensitivity, better worldwide coverage, and most importantly, getting away from those vulnerable ground stations.

Second, on the economic side, over the period of somewhere between the next 15 and 20 years, going with BSTS rather than staying with DSP will pay off. I do not know exactly where the crossover point is, but because BSTS does not need the elaborate ground stations, the operation is much simpler, the operating and support costs are less. So eventually it pays for itself. And when it does, we will have a much better system and a modern system that we do not have today.

The third is industrially and programmatic. The Congress, the Pentagon, and industry have cooperated very well in this program over the past few years. We have invested about $1 billion in a very well structured, very businesslike approach to necking down, and we are ready to go. There is nothing left to do in demonstration/validation, it is ready to go into full-scale development.

Senator THURMOND. Mr. Chairman, my time is up. Thank you very much.

Senator EXON. Thank you, Senator Thurmond. Senator Bingaman.

Senator BINGAMAN. Thank you, Mr. Chairman.

General Monahan, last year you wrote a letter to Senator Wilson where you indicated the way in which you would allocate reductions, if there were a 10 percent or 20 percent or 30 percent reduction in the SDI budget, how you would anticipate allocating that. I thought that was a very useful insight into priorities within the administration, and I wondered if we could request a similar letter this year.

General MONAHAN. I would be very happy to provide the same, Senator.

[The information follows:]

DEPARTMENT OF DEFENSE
STRATEGIC DEFENSE INITIATIVE ORGANIZATION
WASHINGTON, DC 20301-7100

June 26, 1990

EA

Honorable Jeff Bingaman
United States Senate
Washington, DC 20510

Dear Senator Bingaman:

During the recent SDI hearing before the Senate Armed Services Committee, you requested an analysis of the impact reduced funding for the SDI program and the Free Electron Laser (FEL) project. I appreciate the opportunity to respond to your query.

First, allow me to reiterate the critical need for adequate funding for this fast-paced research and development program. We are making tremendous technical strides toward demonstrating the feasibility of effective defenses against ballistic missiles. The substantial investment to date in SDI research and development is beginning to pay off, as the next several years will witness a dramatic increase in the number of, and technical sophistication associated with SDI-related experiments and flight tests (see enclosed "Major Technical Accomplishments" chart). The President's FY 1991 budget request for SDI is designed to ensure these critical activities are conducted in a timely fashion and contribute to overall program goals. This budget request is appropriate and deserves your support.

As you know, the SDI program has been structured to be wholly consistent with Presidential guidance. That guidance contains the following key elements.

-- Prepare for a "decision on deployment" within three years.

-- Pursue options for layered defenses, which could meet the stated JCS requirements for Phase One defenses. (Although the SDI program is guided by the need to develop options for Phase One defenses, the technologies being explored are the same as those which would be pursued for defenses which could protect against limited strikes.)

-- Emphasize promising concepts for boost-phase defenses, such as Brilliant Pebbles.

-- Maintain the schedule for Phase One as close as possible to that which was submitted as part of the FY 1990 budget request.

-- Comply with all international legal obligations, including the ABM Treaty.

In line with Fletcher Commission and JCS recommendations, we also continue to maintain a balance between mature and advanced technologies so that defenses can remain effective over time.

At present, we are complying with this guidance. However, were the Congress to freeze SDI FY 1991 funding at the FY 1990 level, our ability to continue to do so would undoubtedly suffer.

Although it is impossible now to project precisely how such reductions would be distributed across the program, I expect the following changes:

-- We would be forced to make premature down-selects between competing and promising technologies and system concepts.

-- The balance we have attempted to maintain between the more mature technologies/systems and advanced concepts for follow-on systems could be undermined.

-- We would be forced to slow progress or cancel many of the key experiments planned for FY 1991.

-- Leverage in US-Soviet arms control negotiations could be diminished.

-- Broadly stated, the range of credible deployment options from which the President might choose would be decreased, as would the breadth of technical information available on which a decision could be based.

-- The program would suffer stretch-out costs and would require contract restructuring and renegotiation.

-- The planned work force could be reduced by 6,000 to 7,000 from what would be employed under full funding.

-- Innovative science, small business, and university grants would suffer cuts.

-- Research on technologies on the Critical Defense Technologies List (CDTL) could also suffer cuts. (Note: SDIO is the sole DoD organization responsible for carrying out research on many of the technologies on the CDT List.)

This is only a partial listing. Specific programs and experiments would also have to be re-evaluated in light of the strategy selected to adjust to the budget reduction. Any strategy would entail certain risks and costs and, before being implemented, would have to be carefully analyzed, not only in terms of specific programs, but also in terms of the overall goals of SDI. Concerning the FEL project, I feel it is important to maintain our planned investment as requested (FY 91, $130 million). However, that planned level is clearly contingent upon the appropriation. As discussed earlier in this letter, a budget reduction will result in reevaluation.

Whatever the program strategy selected, or the level of funding approved, I believe it is very important that the current schedule for Boost Surveillance and Tracking System (BSTS) be maintained. This satellite is needed to resolve critical shortfalls in our Tactical Warning/Attack Assessment (TW/AA) and other non-Ballistic Missile Defense (BMD) requirements, and we need to hold together the industrial team whose performance, to date, has been excellent. Additionally, when compared to the current Defense Satellite Program (DSP), BSTS will provide increased security and pay for itself by the end of the next decade by eliminating the need to rely on and operate the current overseas ground stations.

In summary, continued technical progress is possible only if the Congress approves adequate funds. The program is on track and has been structured to support the President's stated policy objectives. Cuts in the FY 1991 budget request for SDI would undermine our ability to achieve these objectives, and I therefore urge you to support a robust funding level for this critical defense program.

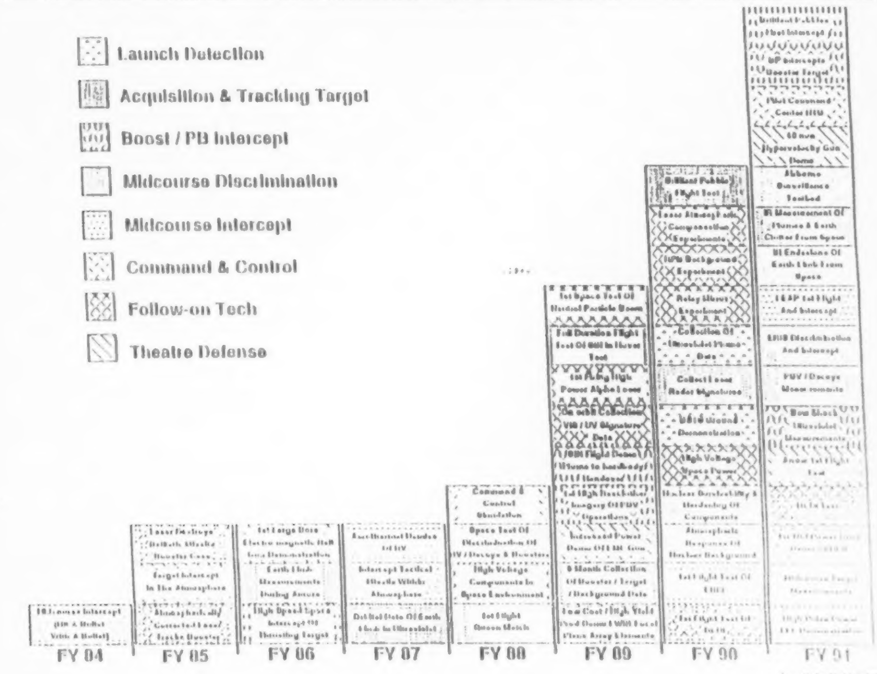
Sincerely,

GEORGE L. MONAHAN, JR.
Lieutenant General, USAF
Director

Enclosure:
As Stated

cc: Chairman, Committee on Armed Services
Ranking Minority Member, Committee on Armed Services

MAJOR TECHNICAL ACCOMPLISHMENTS



Senator BINGAMAN. I would appreciate it.

Let me ask about part of the directed energy program that is this free electron laser. There is a technology integration experiment which you went through on one of your charts there at White Sands. And last year when we discussed this you indicated to me that the projected funding for that was $170 million for the next several years, and that that was a minimal program as you saw it.

In fact, we funded it as $130 million this year, and I understand you are proposing to do the same next year. At that rate, can you realistically go ahead with this program? And what would you expect to happen to that funding level, given a significant cut by the Congress in SDI's budget this year?

General MONAHAN. At the $130 million a year level, we can still have a significant program. We have had to cut down on the size of the laser. We had to push the schedule out somewhat. We cut down on the power of the laser in order to be able to accommodate that. So we can still, I think, have a meaningful program at $130 million a year.

If, however, the SDI program is cut, then we must expect, I think, that there will be cuts in the free electron laser part of the program. And indeed we may get down to a point where it is really no longer viable to continue.

Senator BINGAMAN. You are saying that if the overall budget is cut you would expect to cut this program. And if you cut this program, it would not make sense to go ahead. Is that what you just said?

General MONAHAN. You would finally get down to a certain point, Senator. And I think we are pretty close to it right now at $130 million. We still have a good, meaningful program. If we had to cut that very substantially at all, I think we would have to look very carefully to see if it really made sense to keep proceeding on the path we are on today.

Senator BINGAMAN. And you will be able to address that in the letter that you are going to give us as to where that program would remain?

General MONAHAN. Yes, indeed.

Senator BINGAMAN. Let me ask about this informed decision which the President wants to be able to make in the summer of 1993. When was it decided that that was the time that the informed decision should be made?

General MONAHAN. That was contained in a directive from the President in which he said that he wanted to make a decision within 4 years.

Senator BINGAMAN. So it was early in his administration?

General MONAHAN. It was last summer, yes, indeed.

Senator BINGAMAN. I guess I have some problems with us sticking to that decision date. And let me explain my reasoning on it. It seems to me that since that date was established for this informed decision on whether to go ahead with full-scale development for the Phase I system, we have had some fairly significant changes in the world.

We have had a significant reduction in the threat. We have had what appears to be a decline in the revenues that are going to be available for this program. And when you look at your chart, the one you have given us here that lays out the dollars that you are spending this year and how you would change that allocation of dollars next year, it is clear that each year Phase I takes on a larger and larger share of the total.

This year I think you are proposing to go up 38 percent in the funding for Phase I, or something right around there. It is fast becoming the blob that ate Los Angeles, that part of the budget is. And I am just wondering, it seems to me that the over-emphasis of your budget on Phase I is driven by this decision date which is now no longer appropriate.

Why cannot we get that revisited? Dr. Herzfeld, maybe you could tell us why we have to decide on the question of full-scale development of a Phase I system by the summer of 1993.

Dr. HERZFELD. I would like General Monahan to go first, but I would be happy to chime in.

Senator BINGAMAN. Well, either order you would like. I would like to hear from both of you.

Dr. HERZFELD. Perhaps Secretary Hadley.

Mr. HADLEY. Senator, I will take a whack at it.

Certainly a lot has changed since the summer a year ago. One of the things that we have done within the Department is to try and look again at the SDI program in light of those changes, and see whether it still makes sense. This is something I tried to address in my opening remarks, and in the written statement. It is something that Senator Warner addressed in his June 18 New York Times article which was referred to earlier.

Senator BINGAMAN. I am not asking whether the whole system makes sense, I am asking whether it makes sense to make a go or no-go decision in the summer of 1993. Why does it have to be then, given the present circumstances we face, budget-wise and threat-wise?

Mr. HADLEY. I think the point, Senator, is that we think threat-wise, while there may be some adjustment and change in the Soviet threat, there are emerging threats for which SDI still continues to make good sense. And it is the prospect of a deployment decision which has been the basis for the program. We have a program which supports that decision.

In light of those threats I think we come around to the other way and say we do not see any reason for change. The second point I would make is, as I mentioned, we are looking at the kind of contribution that SDI can make to some of these emerging threats, in terms of the Third World and the like. And we can do that consistent with moving the program in the way that it is now. To do the kinds of things you need to do to assess those threats, you need to work on the kinds of technologies that General Monahan is working on at the present time.

So we think it is a win-win situation, that it makes sense programmatically, and it makes sense in terms of the threats that we see out there.

Dr. HERZFELD. Could I add to that, Senator? I think what Secretary Hadley says is exactly right. However, I would like to remind you and the other members of the committee that it takes 10 to 15 years to buy these things if you really mean to have one, so you are back to the old conundrum of trying to restore a forest that burned down, since it takes 20 years to grow a big tree. Do you start immediately, or do you wait 5 years? It all depends on when you want the forest. You know the old joke. In that case, let us start immediately, if it takes that long.

The President, I think, is taking a rather prudent point of view in saying he wants this development to proceed for awhile until one can make an informed decision whether this system is the right kind of system to solve all the problems that Secretary Hadley described.

Senator **Bingaman**. Let me just comment very briefly, and then my time is up. I just think, in order to get to a position to make an informed decision on Phase I in the summer of 1993 you are jeopardizing and cutting back on support for much of the long-range technology, which I think is much more important in the long run, as far as this program is concerned.

Thank you Mr. Chairman.

Senator **Exon**. Thank you, Senator Bingaman. Senator Wilson.

Senator **Wilson**. Thank you very much, Mr. Chairman. Let me congratulate all members of the panel. In particular, since this will be his last appearance, I congratulate General Monahan for his stewardship. I think he has given very great service to the Nation.

Let me ask a couple of questions of Secretary Hadley. I think you have actually responded to a number of questions I have, but perhaps it would be useful to elaborate. You have indicated that "despite what appear to be changing Soviet intentions, the requirement to deter Soviet strategic capabilities will remain," and you have indicated why you think SDI represents the most effective means of doing that.

One of the points you raised, and I think properly, is what you termed the growing threat posed by Soviet mobile missiles. From what I am reading in descriptions of the proposed framework for START agreement, it sounds very much to me as though the disparity that presently exists between the Soviet mobile capability and the lack of one on the part of the United States will continue. For that reason, it may be unfair to ask you this question—you are not directly charged with this responsibility—but perhaps you would care to comment.

It seems to me that there might be some wisdom in linking explicitly the ability of the United States to proceed with the capability that we feel necessary and other elements in that START agreement. I think there are very good reasons, some of them political but some of them geographic, why the United States will never be able to have the same mobile capability as the Soviet Union. We are not a nation that is 11 time zones wide. We do not have the same ability for concealment. For that reason, I think it is simply reality to note, to take judicial notice, in effect, that we will never be able to have the same mobile capability, and that for that reason we need to offset and compensate for it.

Mr. **Hadley**. I agree with that Senator, and I think again this is an example of how we have tried to make our arms control and our procurement programs work together. I think what you say is right. We do need a mobile program of our own to introduce some survivability into the land-based leg.

It probably will not be as robust as the Soviets, and we have moved hard on them to look with us about the possibility of getting rid of the MIRVed, silo-based ICBMs which are a threat to our force structure here, and certainly the ability to deploy defenses is a way of dealing with the very fact that you mentioned—that they will probably continue to be some asymmetry in those two forces. So I would agree with that.

Senator **Wilson**. The other question I have really relates to the point that you make, and I think it is a compelling one, that (on page 6 of your testimony) "it is only a matter of time before the United States itself is directly threatened by these systems,"—"these systems" being those that you referred to under the heading of "Emerging Threats," and you specifically cite the danger to Israel from the recent threats of the Iraqi President Saddam Hussein to attack Israel with chemical warheads.

But as you noted, and I again quote you, "in projecting power we are likely to be operating within the range of these threats." I think you are absolutely correct in that, and it seems to me that for that reason, in order to be able to project power credibly, and still do so with the assurance that we will be able to safeguard against attack on those deployed American forces as well as those that are dispatched against our allies, one of the urgent necessities is to proceed to an agreement on Phase II of the ARROW project.

Because I think that we are facing a threat not just to Israel but a very clear threat, made explicit in the threat of Saddam Hussein, but also a threat, for example, to an American fleet standing off Lebanon, to an American expeditionary force any place in the Middle East, to the naval presence in the Persian Gulf, were we required to undertake such a mission once again. It seems to me that that is an urgent necessity. I would be interested in your comment there.

Mr. **Hadley**. Senator, we are looking at not only that program but what other kinds of capabilities we need to deal with that threat and to make sure this is one of the things that General Monahan and we are looking at to make sure that we have in train the kinds of capabilities that we will need for that. Certainly the ARROW is one, but my point is, we really want to look more broadly. This is an emerging threat, and we have to make sure that the total program makes sense for dealing with it. That is certainly one aspect, and we are looking at that aspect.

Senator **Wilson**. I will simply add a comment, Mr. Chairman, that in my own view I think we should not only undertake the kind of agreement that will launch us upon Phase II of that project, but do everything within our power to accelerate it. Time is not on our side in what clearly is a race against the clock and against some rather irresponsible, radical leaders.

At a time when super-power tensions may be cooling, I think we can take some comfort in that, but at the same time we cannot ignore the kind of threat that has been made explicit by Saddam Hussein and others who are hastening to develop that same kind of missile-delivery capability.

Thank you, Mr. Chairman.

Senator **Levin** [presiding]. Thank you, Senator Wilson.

First, general, let me add my thanks to you for your decades of service to this country. We are all in your debt for it.

On the size of this budget request, first of all I have real difficulty with it. Again, the administration is coming and asking for a significant increase over last year's budget request for SDI. Since last year, we have got a much larger budget deficit than we expected coming up. Even the President acknowledges that. The threat of nuclear war is significantly reduced. There may be threats that are still out there, but the threat of nuclear war is significantly reduced, and that was one of the threats—an all-out nuclear war—which was an argument for the SDI system.

Also, inside of the defense budget we have got major conventional systems being eliminated. Dozens of significant, useful conventional weapons systems are prematurely terminated inside the defense budget. At the same time, there is a large increase that is requested for SDI. It seems to be part of a pattern. Each year, the administration asks for an increase for SDI. Each year, it says that increase is essential. Each year the Congress cuts, and I do not think there is any doubt that we are going to make a reduction again in the SDI request.

I might add that despite last year's reduction of about $1 billion, this year you come back and say you are in better shape than ever. I am wondering, if we had cut $2 billion last year whether it would have even led to a great break-through.

General **Monahan**. Not so, Senator. Senator Bingaman mentioned some areas where we had to make some deep cuts we certainly did not want to make.

Senator **Levin**. Generally, the report of progress we have here is great, and that is the argument that is being used to continue, and we made a major cut last year. We were told if we did that it would be a disaster for the program, and what I am saying is that this is part of a pattern.

Where there is an increase asked for, the statement is made that the increase is essential. The Congress cuts anyway, and then next year we are told, hey, things are going really good and we really need an increase this year. So I think you are off the mark, frankly, in terms of asking for an increase in the SDI budget, in an environment where we have got these huge budget deficits that the President even acknowledges now, and we have got the reduction in the threat.

I want to start off my questions as the chairman did, and that relates to the compliance of your current plans with the ABM Treaty. Dr. Herzfeld, I perhaps look to you for your guidance. You have indicated that tests 9 through 12 have not yet been assessed in terms of their compliance. Is the issue there going to be whether or not the life jacket design test, which I gather is an orbital test, is a test of a component or adjunct? Is that the key issue in terms of compliance?

Dr. **Herzfeld**. I think there are a number of issues, and I am not sure some of these can be discussed in an open hearing. We are in the middle of the review. It is not that we have not started yet. We have not finished it. If we had finished it, I could give you the answer. But we are in the middle of it, and it is complicated, and there are three or four factors that intermingle in complex ways, and I am not sure how much of this we can talk about in a public hearing. We can certainly provide something for the record.

[The information follows:]

Brilliant Pebbles flight tests 9 through 12 will not involve ABM components, prototypes of ABM components, or devices capable of substituting for ABM components. This applies to the lifejackets as well.

Senator **Levin**. That is fair enough. But in this document you gave us it says "life jacket design," and it looks like the 9th and 10th dots there. Is that unclassified?

General **Monahan**. Yes, indeed, that is unclassified, that those will occur.

Senator **Levin**. When will the decision be made on test number 9, as to whether that is compliant with the narrow interpretation of the ABM Treaty?

Dr. **Herzfeld**. We cannot make a binding prediction today. We are very close.

Senator **Levin**. Close to a decision?

Dr. **Herzfeld**. Yes, but we cannot say precisely when. We are working very hard, by the way. We are not asleep on the switch. We are working on it.

Senator **Levin**. You talked about a decision on deployment by the summer of 1993, I believe. Is that correct?

General **Monahan**. Yes.

Senator **Levin**. Is that a deployment decision, or a full-scale development decision?

General **Monahan**. I do not know precisely, Senator.

Senator **Levin**. All right. Are any of the tests which are planned to be made before that decision a violation of the narrow interpretation of the ABM Treaty?

Dr. **Herzfeld**. Until the evaluation has been completed, we cannot tell.

Senator **Levin**. So it is possible that none of the tests will be determined by your office to be a violation of the narrow interpretation of the ABM Treaty?

Dr. **Herzfeld**. It is conceivable. I do not know, but it is conceivable.

Senator **Levin**. If in fact any of those tests are determined to be a violation of the narrow interpretation of the ABM Treaty, then if a decision were made to proceed with those tests and to get congressional approval for it, that decision would constitute, would it not, a major Presidential decision?

Dr. **Herzfeld**. I am not sure whether it requires a Presidential decision, but it certainly would require a Secretary of Defense decision to come to the Congress and ask for budgetary approval, as I understand the situation.

Senator **Levin**. Is it fair to say within the next few months it is possible the Secretary of Defense will be coming to Congress and saying look, our Office of Compliance has determined—I am saying here, is it possible that the Secretary of Defense will come to the Congress and say our Office of Compliance has determined that this would represent a test or development of a component in violation of the narrow interpretation of the ABM Treaty and we are coming to you for your approval?

Dr. **Herzfeld**. It is possible that could happen.

Senator **Levin**. That could happen in the next few months.

Finally, Mr. Secretary, let me just ask you a couple of quick questions, then I am going to run and try to make this vote. Your optimism relative to the linkage between START and the ABM issue or the defenses issue it seems to me is excessive. It is misplaced. We have a letter here from Henry Cooper, who is the U.S. chief negotiator for defense and space talks from 1987 to 1989. Have you seen that letter in the Washington Times, June 13?

Mr. **Hadley**. June 13?

Senator **Levin**. I will read it to you if you are not familiar.

Mr. **Hadley**. Please, if you would.

Senator **Levin**. It says here, basically, the Soviets have only changed the form of their linkage demand. Before they wanted U.S. agreement to linkage embodied explicitly in a formal agreement. Now, they simply state that they will comply with START only so long as the United States refrains from developing and deploying a significant SDI system. Do you agree with that?

Mr. **Hadley**. The answer is yes, I agree with that, but I think it is the detail without the big picture, and I know you are rushed. I could go through with you the change we have seen over the last 6 months in their position, and it has been a dramatic movement, and I think we can expect that movement to continue.

Second, I would point out the summit declaration, which is language I think Hank Cooper would have been surprised we could ever have gotten even 6 months ago, so I think there has been some real movement here, Senator.

Dr. **Herzfeld**. I would like to add a sentence.

Senator **Levin**. I must interrupt. I might miss this vote.

Thank you. We have no one here, so we will stand in recess until someone does arrive.

[Recess.]

Senator **Exon** [presiding]. The committee will please come to order. We apologize for the delay. Senator Wallop would be next.

Senator **Wallop**. Mr. Chairman, thank you. I want to begin by—and since he is not here, I will say it anyway—by adding my congratulations to those that preceded me, to you, General Monahan. I really genuinely appreciate the job that you have done and the state to which you have brought us. I would also like to point out in terms of near-term priorities versus long-term research, as I look at your budget only about ⅜ths of it is on Phase I and ⅝ths of it is on the long-term stuff, and that would seem to be, given the world circumstances, about as far as I would like to see it separated.

When the Secretary was asked the other day if he would still recommend that the Nation proceed with the START I agreement even if we were not to get a Midgetman or a rail mobile MX or a B–2 and he answered yes, could it be that he has no confidence that we can get to full-scale development and deployment decisions if we have the will in SDI?

Mr. **Hadley**. I cannot speak specifically to that statement, but I can say in terms of the views he has expressed, he gives a high priority to SDI and I think views as one of the things it can do to provide some protection to U.S. forces, and that could include, obviously, an ICBM force that might remain in silos. So again, I think the point I would make, Senator, is, SDI is a very important part of our whole approach to the strategic equation to moving toward a mix of offensive and defensive forces.

In response to Senator Levin's point, I think it is no accident that in a time when no one is looking harder than the Secretary of Defense for savings in the defense budget there is a request on the SDI program over last year, and I think that shows the priority he attaches to it and the President attaches to it.

Dr. **Herzfeld**. If I may add to that, Senator Wallop, if you take a long view of what has been going on in the strategic force area, we really see that the Soviet Union from the very beginning has had a balanced posture, balanced between offense and defense capabilities. It was true in the early ICBM days, and it is true today.

Whereas, if you look at the United States, we have gone through a number of swings. In the early bomber days we had substantial defensive forces protecting CONUS and our allies. We then lost faith in that, dismantled that. During the early ICBM phase there was the development of a number of ABM systems. They failed for lack of support, though each President tried to do something with it. We went into the 1980s with the same kind of posture. President Reagan changed that and said he would go for a more balanced posture, which was a very far-distant hope, the hope he expressed in 1983.

I think the significant thing that is happening now is that whereas the Soviets have always had for themselves a balanced policy, they have tried to deny us that policy. They say no, no, you fellows only can have an offensive posture, and what we are beginning to see a glimmer of in the negotiations is that they are going along with the United States having a balanced defense policy. I personally think that makes much more sense than an unbalanced policy. All one has to do is ask policemen why they wear bullet-proof vests and you get a good feeling for why it matters, and I think this is somewhat similar.

Senator **Wallop**. Well, I must say that the optimism and the accomplishment that was reflected in all three of your statements leads me to the feeling that the only major limitation we have now is political will.

General **Monahan**. I think that is very clear, Senator. One thing I could add to what my colleagues have said is that what was different in the 1980s from, perhaps, past programs that would have provided some defense against ballistic missiles, is today, from a technical point of view, it is much more practical. It is much more feasible to do it in an efficient way and an effective way.

For example, the system that we propose, the architecture we have, does not have any nuclear warheads, whereas the Soviet defensive systems do, and ours do not at all. We do not need those today because of the advances in technology that allow us to hit very fast-moving targets at great distances.

Senator **Wallop**. It is more difficult to overwhelm, more difficult to deceive, more difficult in all kinds of ways to counter, is it not?

General **Monahan**. Yes, much more difficult.

Senator **Wallop**. Mr. Hadley, regarding the ARROW, if this is the same question that Senator Wilson was undertaking as I left, just please tell me and say that it has been answered.

The joint U.S.-Israeli missile project: has Secretary Cheney made the decision to proceed with the negotiations with the Israeli MOD on a memorandum of agreement for the second phase of the ARROW?

Mr. **Hadley**. My understanding is the decision has not been made, Senator, and I would be glad to provide for the record a more detailed statement on its status. My response to Senator Wilson was simply to say that we are looking at this whole area of defense against, really, sort of tactical ballistic missiles, and that certainly is a piece of it, but we want to make sure we have an integrated and sensible approach to the whole problem. But my understanding, in answer to that question, is no, but I will provide some specific information.

Senator **Wallop**. In providing your answer, would you also just give us the reason why not?

Mr. **Hadley**. Yes, sir.

[The information follows:]

Arrow Follow on Experiments

The Department is in the final stages of reviewing the Israeli proposal for a second phase of the ARROW program. As I indicated in my testimony, our review of the SDI program in light of the changing international security environment led us to conclude that more emphasis on countering the theater ballistic missile threat was required. Many of our friends and allies, in particular Israel, face a serious and growing ballistic missile threat. We are actively looking at ways the SDI program can help to provide answers to these threats, and theater defense systems (of which ARROW is the most mature) will receive greater priority.

I expect Secretary Cheney will make a decision regarding our continued involvement in the ARROW program in the very near future. We are aware of your interest and that of many of your colleagues in this program, and we will notify you as soon as a decision is made.

Senator **Wallop**. Mr. Chairman, my time is up, but let me just ask you, given the testimony of today's witnesses that the fiscal year 1991 SDI program is in compliance with the ABM Treaty as referred to in section 225 and in your questions, must we insist that another public law similar to the fiscal year 1990 authorization bill be included in this year's bill? Can we not just accept the word and the testimony of these witnesses?

Senator **Exon**. If you are asking me the question, I would think that if we would include it and make sure that it is in the bill along the lines of the questioning that was very directly responded to by the witnesses, I think that is the best way to lay it to rest. But I would be glad to talk to the Senator from Wyoming if he has some other view.

Senator **Wallop**. It just seems to me it is a public law requirement and they have testified that they are in compliance with it, and it seems vaguely insulting for us to say it once again, as though we did not trust the words in response of these witnesses. But I will talk with you. Thank you.

Senator **Exon**. Thank you. Senator Gore would be next.

Senator **Gore**. Thank you very much, Mr. Chairman. I enjoyed the testimony today, gentlemen. It seems to me that if Brilliant Pebbles works, and if it does work, then we are back where we always thought we might be, trying to decide whether or not partial defenses are intelligent things to pursue. If something is feasible, that does not necessarily mean that it is smart. We have to decide what we want beyond START: deep cuts plus stability, sharply reduced forces plus stability. If we have sharply reduced forces plus defenses, then we may very well have a first strike problem much worse than the one speculated upon heretofore.

I think it is better to concentrate on stable reductions without the enormous distraction of the deployment of SDI. Are you prepared to answer questions about the final report of the Defense Science Board on Brilliant Pebbles? This is marked "For Official Use Only," and I do not know if it is all right to ask you to respond to questions about that or not.

General MONAHAN. I believe, Senator, that you could ask the question. I will make a judgment as to whether or not it requires going classified.

Senator GORE. Well, what you have said here this morning seems to me to be in direct conflict with what the Defense Science Board has said about Brilliant Pebbles in its final report. Is your testimony here in your view consistent with the Defense Science Board's assessment?

General MONAHAN. Entirely, Senator. We asked the Defense Science Board and the JASONS last year to answer a very key, critical question for us which was, do they see any real show stoppers?

Senator GORE. That is not what I am getting at. Are we now in a position to decide that Brilliant Pebbles should replace the earlier architecture of SDI?

General MONAHAN. Yes. We looked at that subsequent to what the Defense Science Board and the JASONS did. We conducted further studies of our own on that subject and we concluded that the advantages were way in favor of the Brilliant Pebbles approach versus a more conventional, space-based interceptor approach. As a hedge, though, we have continued effort on the space-based interceptor approach to the extent that funding would allow us.

Senator GORE. So there is a sharp difference of opinion between the view you are now expressing and the view expressed by the Defense Science Board?

General MONAHAN. No, I do not believe so, Senator. I believe that report and what we have done are very much in accord. As I said earlier, the Defense Science Board thought that we needed to keep effort underway as a back-up on the conventional space-based interceptor, and we have done that.

Senator GORE. Begging to differ, the Defense Science Board specifically says that Brilliant Pebbles should not replace the space-based interceptor in the base line, in the architecture, and they say that Brilliant Pebbles' design is neither complete nor stable, and not a well-defined program acquisition strategy, and that there are other problems and that it should not replace the space-based interceptor in the base line, and that the architecture should not be changed.

So it seems to me that there is a difference between—night and day—between what the Defense Science Board says about Brilliant Pebbles and its relationship to the architecture, and what you are saying. You are saying you are now ready to replace the older architecture. As a hedge you want to do both, as if we can afford to do either, when we get the final cost estimates. We do not know that yet. But they say that we should not replace it. You say that you are now in a position to decide that we should replace.

General **Monahan**. Yes. Subsequent to that we have had meetings by the Defense Acquisition Board. They have met on the subject, and their committees have, over the period of the last few months, and they have approved the approach, now, that puts Brilliant Pebbles up front. I hasten to add that Brilliant Pebbles and all the other elements that we are proceeding with are all candidates. They are all options. They provide options to us.

Senator **Gore**. Well, has the Defense Science Board put out a subsequent report to what they call their final report on Brilliant Pebbles?

General **Monahan**. Not to my knowledge.

Dr. **Herzfeld**. They have not been asked to do that yet. I think it is likely that they will, but a good deal of work was done since that particular work was carried out by the Defense Science Board and some of the results were reported on to General Monahan, and they have persuaded their relevant people in the Defense Department that this move is a prudent one.

Senator **Gore**. Are we willing to share Brilliant Pebbles with the Soviet Union? That is what President Reagan proposed. That is part of the concept behind SDI. Mr. Hadley?

Mr. **Hadley**. That is a good question, Senator.

Senator **Gore**. Thank you. What is the answer?

Mr. **Hadley**. That is a little harder. One of the things we have tried to do is take away some of the mysteriousness from this technology. We have done that through the visits that General Monahan had referred to. We have proposed a predictability measures agreement in which the two sides would exchange information and data on their various SDI activities. There would be exchanges of briefings, exchanges of experts, visitation to facilities, so they are learning a lot about the kinds of things we are doing.

The question about whether—if we made a decision to deploy—we would give that system to the Soviets and offer a two-sided deployment, I think quite frankly that is an issue that really is a bit premature, and so far as I am aware we have not addressed in a systematic way.

Senator **Gore**. So in the larger design of the SDI program, you are replacing the original proposal to share that technology with psychological counseling of the Soviet Union so that they will feel better about not having it?

Mr. **Hadley**. No, Senator, I would not sign up to that. I think the issue about actually sharing the technology and the status of that proposal within the administration is something we really have not systematically addressed. It may be something I am not aware of, and I would be glad to take that question and see if there are folks more knowledgeable than I.

Senator **Gore**. Let me conclude. My time has expired.

I just want to briefly conclude by saying that I took note of your agreement earlier, Mr. Hadley, with a statement that a new rationale for your project here is that we cannot deploy mobile missiles. I disagree with that, but you apparently agreed with the statement that difficulty deploying mobile missiles gives us a new need for Brilliant Pebbles.

I think that that is an unfortunate view and that it is a self-fulfilling prophecy if others in the administration come to agree with that. I know that General Scowcroft does not agree with that, and I know that that is not our position in Geneva, so I hope that you will reconsider that and I hope also that you will reconsider the view that this is the answer to "nth" country, or third country, or terrorist weapons, because the use of a cruise missile or a ship in a harbor, or smuggling it in hidden in bales of marijuana, or some other deployment method, would easily defeat this kind of approach.

My time has expired. I hope we will have another round, and I thank you, Mr. Chairman.

Senator EXON. Thank you, Senator Gore. Senator Glenn.

Senator GLENN. Thank you, Mr. Chairman. Since back in the days when General Abrahamson was running the program, General Monahan, I have been concerned about the direction that the program should be going.

In the Defense Science Board report of December they say, and I quote, "The SDI program appears to suffer from a conflict of purpose. At times, the program has emphasized research on new and better technologies and concepts. At other times, it has emphasized deployment of a system. These two aims are in competition, especially in view of the nature of the existing acquisition process."

They go on to say, "Although SDI is supposed to be a research and development program, the build model has been applied and has led to fixing the system design too early, before adequate exploration of alternative technologies was completed," and I have other quotes here also. Is there a schizophrenia in the program and are we just sort of funding everything we can get money to fund? Is that the purpose, or do we have it better defined than the Defense Science Board seems to think?

General MONAHAN. A very good question, Senator Glenn. First of all, we have very clear directions as to where to go, in the program. The President has provided that to us. He provided that last summer. Perhaps that did not get out until after the DSB's work was completed. I really do not know.

Senator GLENN. This DSB report was in December.

General MONAHAN. So I personally, in my job——

Senator GLENN. December 29, 1989 is the report date.

General MONAHAN. That was when it was finally published, I know. I do not know what access they may have had to certain directives. But I have never, in my job, felt that I was lacking as far as guidance and leadership and direction from above. That has been very, very clear to me. It is very well spelled out, and I have no difficulty with what we have.

I think we have a very good mix here, and we look at this, and we judge it all the time. What is the right amount to be putting on the more or less near-term, kinetic energy systems versus the raw technology, which is just so vital to us? So we need to keep going, get the right amount there, and then looking at the directed energy weapons out in the future. We use the guidance that we have received from the President in making those determinations.

Senator GLENN. What has bothered me when I go out at least once a year, and visit the national weapon labs that are doing some of the research on this, basic research, and those people tell you, still to this day—that we are 10, 15, they do not know how many years away, from having lasers or neutral particle beams that are usable for our purpose that we had in the original concept.

At one time, we were moving in the first stages of what I saw as deployment. Then we backed off that. Now we are at Brilliant Pebbles, but we are still going with the other technologies. They said in the Defense Science Board report: "We do not believe Brilliant Pebbles should replace the SBI in Phase I SDS—strategic defense system—base line at this time for two reasons. First, the BP design is neither complete nor stable, nor is there yet a well-defined program acquisition strategy for transitioning BP into system acquisition. A move to adopt the BP concept would therefore create substantial upset and delay. Second, the pressures that would be generated to freeze the BP design would hamper and probably soon end the desirable process of improvement now underway." Yet we are talking about the President making a deployment decision within—what is it, 2 years?

General **Monahan**. Again, since this was written, and indeed while it was being written, we developed, I think, a very good acquisition strategy for Brilliant Pebbles, a way to bring industry on board.

By the way, in so doing, Senator, we are looking at the schedules that we had for the more conventional Space-Based Interceptor program—people call it more conventional, I call it much more complex. The schedule for Brilliant Pebbles is shorter by—and I cannot get into classified numbers, here—a few years from what we would have had under the other system. It is cheaper, and we, as I said, have developed the acquisition strategy.

We have had advice from many, many groups besides the Defense Acquisition Board on this, who have looked at it very, very carefully. So it makes a lot of sense to be emphasizing Brilliant Pebbles rather than the older, more expensive, more complex conventional space-based interceptor approach.

Second, you raise a very, very good point about well, at one time, it looked like a lot of emphasis was on the directed energy weapons. Perhaps that was so, back before more started to gel as far as the architecture is concerned. As we see it today, as I said in my remarks earlier, it is sometime after the turn of the century before we could have weapons, prototypes of the directed energy weapons. They need a lot more in the way of basic research work than do the kinetic energy weapons.

The President has told us that he wants an option to be able to deploy a system before the turn of the century. In order to do that, we have to go with the kinetic energy weapons, and we do that with Brilliant Pebbles on the space side and the ground-based interceptor on the ground side.

Senator **Glenn**. A big threat justifying this program has been the Soviet Union. Surely we are not going to base SDI deployment on the fact that Iraq has a missile that will go 1,000 or 1,200 miles. I think that trivializes the whole thing, I really do. I do not think we are going to build a system like this because Third World nations are getting some missiles. Now, maybe that becomes important somewhere down the road, but I really cannot think that Iraq poses a serious threat. We could obliterate Iraq any day we decided to. They know that, and that is our best deterrent. So are we going to deploy SDI, giving as a reason for doing so that Iraq and nations like that may get ballistic missiles?

General **Monahan**. No. I believe the basic reason remains the same, and that is to deter an all-out nuclear war. Now, despite the changes that have taken place over the past year that we greatly welcome, we still note that the Soviet Union has a strategic nuclear force that is stronger today than it was a year ago, and much stronger today than it was 5 years ago. Under Mr. Gorbachev they have deployed the SS–24 and the SS–25. We have to worry about that capability.

We are very pleased to see what we think are improved intentions, and we have much improved relationships. We encourage those. We hope that that will last forever and ever, but we know the intentions can change overnight, whereas the military capability cannot. So that capability exists in the world, and you know we can never be sure that it is going to be in friendly hands.

There is one other thing, Senator, regarding Third World nations. You know, deterrence and a deterrent posture demands rationality, and we worry about nations or leaders who have demonstrated in the past they do not always act rationally, and perhaps they may not do so in the future. We now have the capability at hand to defend our people against the accidents or the rogue launches or the terrorist launches, or whatever. So now we really need to look very carefully at whether or not we should provide that kind of protection.

Senator **Glenn**. Well, my time is up, but I have a real concern about trying to move to a decision to go to a deployable system and start cutting hardware in 1992. I cannot imagine, in my wildest dreams, that we are going to have the answers to Brilliant Pebbles and directed energy and all the other things that would be needed to really go for deployment. Unless you can catch almost all incoming missiles in an attack, it really does not pay to go with much of the system. It is hard to see how we are going to do that, and make a decision by 1992.

Senator **Exon**. Thank you, Senator Glenn. I am going to recognize Senator Shelby next, but along the lines of questioning that I have been listening to, and it is most interesting, I guess the good news is that it seems that we are becoming more realistic all the time on the future of SDI. You are expert witnesses, and maybe we ought to put to rest once and for all, right now, something that this Senator was very much upset about early on.

We do not envision today, do we, that we are going to have a nuclear umbrella? You all remember those crude drawings on the television screen where the little girl would draw with a yellow crayon and then nuclear devices would bounce off of it. Just to put that to rest once and for all, you experts gathered here would agree with me that this representation was not a realistic proposal then and it is certainly not now. Is that correct?

General **Monahan**. I would agree with that, Senator. Against a massive Soviet attack, there is just no way that we could have something that is impregnable. We could thin it out very, very substantially and hopefully deter now against a limited attack, if one is launched, or two, in an accidental way, et cetera. Then we would have an opportunity to take multiple shots and I think you would come very, very close to 100 percent effectiveness there. But that is against just a very small attack.

Mr. **Hadley**. I think the point is, Mr. Chairman, we find defenses can still make a substantial contribution to stability to a mixed force of offenses and defenses, at levels and effectiveness that are below what you have referred to.

Senator **Exon**. That was not my question, Mr. Secretary. My question was, the nuclear shield, or nuclear umbrella, was a faulty premise to begin with, right?

Mr. **Hadley**. We have got a new and revised understanding which we think makes for a sound program for you, Senator.

Senator **Exon**. Good doctor, what do you have to say about that?

Dr. **Herzfeld**. I think it was an optimistic goal. I think it was worth trying for, because it would have been important if it could have been done, but as my colleagues and others have said, and would say, there are a number of very important things we can solve. We have learned to solve important military problems. I am in favor of solving those problems.

Senator **Exon**. You called it an optimistic goal. I have always referred to it as an unrealistic dream. Senator Shelby.

Senator **Shelby**. Mr. Chairman, I would like to follow up a little on the subject matter you were into. If you do not have the umbrella, you certainly would create a lot of uncertainty on the other side, would you not, as to what would get through, how many would get through, and that would have to be a deterrent? Doctor, do you want to comment?

Dr. **Herzfeld**. I agree with that. I think that is the nature of deterrence, in fact—to remove certainty from the planner, the opposite planner, about the effect of an attack of any size, or any objective. If there are no defenses, then the calculation turns unto a game of statistics. If you know the reliability of devices, you know how many you have to launch in order to estimate very closely how many are going to arrive at their targets.

Senator **Shelby**. Like in the Second World War, if somebody was going into an area to bomb and there was no anti-aircraft fire, or if there were no fighter planes to oppose them, heck, you had certainty.

Dr. **Herzfeld**. It was called a milk run. Not so if there are real defenses, even if they are not 100 percent perfect.

Senator **Shelby**. But they do not know that, do they?

Dr. **Herzfeld**. There is an old problem here that has unfortunately not gotten the attention it deserves. The defense has to be conservative in its estimate of what it can do, and the offense planner has to be conservative in estimating what he can do, if there is offense and defense, and there is a pretty big gap between the expectations of the attacker and the expectations of the defender, and this gap is in fact a deterrence. A persuader, a dissuader for both. Let us not do it, whatever the "it" is. So I agree completely. I think you have hit the nail on the head.

Senator **Shelby**. If we achieve that, then we have achieved our goal.

Dr. **Herzfeld**. I would think so.

Senator **Shelby**. I want to get into another phase. At what point in time, if you do, do you expect to begin testing that would not comply with the ABM Treaty without going through the exercise of whether you are in compliance or not in compliance? We have done this a couple of years ago, and I say this because it seems to me that there will be a point in time when the program that you are espousing and we are financing and authorizing will have to move beyond where you are now, especially in space. So the ground-based system to a defense system seems to be moving along pretty well. We have had some success there.

So if you believe that you are going to have to ultimately, if you do, move out in the testing area in noncompliance with ABM, do you believe the President has this intention in mind, to break out of this treaty? General, do you want to comment on that? First of all, will you sooner or later have to move into an area that will obviously be coming out of the break-out of the treaty?

General **Monahan**. Certainly. We think we can go until about 1994 or 1995 by taking certain measures and do all testing within the restricted interpretation of the treaty. Under a broad interpretation of the treaty we could go much, much further than that, almost right up to the point of deployment. I think the thing that is important about the ABM Treaty is what it says about deployment. I do not think we should get into divisive discussions on broad versus narrow interpretation. What is really important about the treaty, of course, is that it denies us deployment. We may not deploy the system within the constraints of the treaty.

Senator **Shelby**. You have indicated you are not ready to deploy now, right?

General **Monahan**. No, we are not. But, nevertheless, you make preparations, you spend the money, you make a lot of plans, commit a lot of resources, so the major issue that we really need to work on, it seems to me, is that issue of deployment of a system under the ABM Treaty, rather than worrying about the broad versus narrow.

Senator **Shelby**. Doctor, did you want to comment?

Dr. **Herzfeld**. I think it is important to realize the treaty specifically allows for modification of the treaty, so it is not a matter of abrogation or withdrawing of the treaty. I would much rather my colleague, Secretary Hadley say this, but you asked me. I think the next logical step would be to try and sit down with the Soviets and negotiate a modification.

Senator **Shelby**. When this treaty was entered into and subsequently ratified, would it be a fair statement that a lot of the scientific break-throughs were imaginations? That most people—in other words, in the last 18 years that we have made so many break-throughs—we have made so many in the last 2 or 3 years, by leaps and bounds. Is that a fair statement?

Dr. **Herzfeld**. Let me comment on that. Twenty-eight years ago I ran the program that George is running now, the defender program. Many of the things that he has done, we were dreaming about. It is indeed true that a number of remarkable technical advances have happened, particularly in the computing sense, or in guidance areas.

Senator **Shelby**. What about the areas of fiber optics and lasers, though? Do you know what I mean?

Dr. **Herzfeld**. I personally found ARPA orders for high-powered lasers in 1961. They were pretty small by today's standards, but we knew why we were doing it. You are absolutely right, it simply was not feasible then, although the ideas were potentially feasible, and what is important that has happened in the 1980s is that we again got a real program that put some of these things on the map.

Senator **Shelby**. Also realizing some ideas, or dreams, that you have seen come true.

Dr. **Herzfeld**. Some pretty exciting stuff, actually.

Senator **Shelby**. Let me move to a different area. As the chairman said earlier, General Monahan, we do not want you to retire, but we know you are going to and we wish you well. You have given—what?—35 years now to the Air Force.

General **Monahan**. Thank you.

Senator **Shelby**. When you do retire, as your successor comes along, I for one recently wrote to Secretary Cheney requesting that he seriously consider an Army officer to fulfill this? Will he do this? I do not know, but I believe that there are Army officers and Air Force officers out there—you happen to be an Air Force officer who has done a good job here, but I believe that there are Army officers here that are experienced, that are qualified to fill a position like this. Dr. Herzfeld, do you have any comment on that, or is it strictly limited to the Air Force?

Dr. **Herzfeld**. There are professionally-trained and enormously capable officers in every one of our military services who would be able to manage this job.

Senator **Shelby**. Including the Army, right?

Dr. **Herzfeld**. I said everyone, sir. That certainly includes the Army, and also the Marine Corps and the Navy, if I may add.

Senator **Shelby**. But since the Army and the Air Force both have been very involved in SDI in different areas, I was trying to conform my remarks to those two branches. Secretary Hadley, do you have any comment on that? Are you going to stay away from that one?

Mr. **Hadley**. I am going to stay away from that one, Senator.

Senator **Shelby**. My time has expired. Thank you, Mr. Chairman.

Senator **Exon**. Thank you, Senator Shelby. Let me just say that I think it is up to the Commander in Chief to make that decision. I do hope, though, that as long as we are talking about who might run this program in the future who is qualified, I would just unofficially state for the record now I would hope that the Congress would agree that nobody in the Congress is qualified.

Senator **Shelby**. If the chairman would yield, I would hope that would pass unanimously.

Senator **Exon**. I will not bring it up for fear of a filibuster.

Let me ask of you, Mr. Secretary, as I look at the fiscal year 1986 to 1990 POM on this particular chart, you plan to ask for about $5 billion in fiscal year 1987, over $6 billion in fiscal year 1988, about $7.5 billion in fiscal year 1989 and nearly $9 billion in fiscal year 1990. Now, over those 4 years, the Congress actually appropriated

$3.2 billion in 1987, $3.6 billion in 1988, $3.7 in 1989 and $3.5 in 1990.

In none of these years, I submit, since the SDI program was established, has the SDI received even $4 billion, yet as I understand it Secretary Cheney has allocated $58 billion to the SDI in the 6-year defense line covering fiscal years 1992 through 1997. I am looking again at this chart, here. These are the figures on this chart that I just cited, and then this is the appropriated figure down below.

It is rather dramatic how the Congress has not gone along with recommendations of the previous administration or this one. The facts are that the average of $10 billion a year that the Secretary is requesting is far above what we have ever provided previously, even in years when we did not have the budget crunch that we have now. If the Congress heretofore has not been willing to go above $4 billion, what do you see that is so different this year, and projecting the years that immediately follow, that would persuade the Congress to significantly shift its course on the amount of total funding for SDI, again given the budget crunch?

Dr. Herzfeld. Who would you like to answer, sir?

Senator Exon. I would think the Secretary would be the one that would answer that.

Mr. Hadley. I will give it a shot. I will then go to my colleague, who says there is a classification issue.

I guess I would make this point. The program is at a point where, if we are going to proceed—and I think General Monahan can talk better about this—to develop the technologies that are there, it is going to have to grow, and what we would hope to convince the Congress of is that they have seen real value and benefit from the investments that have been made in this program in the past, and that it is technically at a point that would justify the additional investment, and that the rationale for the program warrants it. So it is quite right it is going to have to ramp up if we are going to pursue the program, and that will require us to be able to convince you on both of those factors.

Dr. Herzfeld, do you want to add to that?

Dr. Herzfeld. Steve Hadley makes the important point. If we are going to be serious about any of this and follow the President's guidance, there are certain things that have to be done between now and then, and the Secretary is convinced that is what he needs to do and wants to do.

With the details and numbers that you have quoted there is a classification problem, as I understand it. The POM numbers cannot be used, at least by us, in an open hearing, until they are part of the package being submitted officially, so I think we should stay away from picking up particulars here. But the trend is clearly there because of the reasons that Secretary Hadley indicates.

General Monahan. I would like to add two things. I support, first of all, what Mr. Hadley had to say, and that is the program is at the point now where it needs to have this ramp up if it is to proceed, and proceed in a reasonable fashion. That is the first thing.

Second, it seems to me, in the environment we find ourselves in the world today, when we have been looking at our military posture, our strategic apparatus, that clearly under that kind of a review that certainly some programs perhaps go down and perhaps some go away, but perhaps some increase. You look at the situation that we are faced with, with the strategic capability of the Soviet Union being maintained and even getting stronger, whereas I think you can find a dramatic difference as far as the threat from their conventional forces, the threat from their conventional forces at this time is probably greatly reduced.

Then, looking at that strategic situation, it seems to me that that logically leads toward strategic programs perhaps being more adequately funded than others. In other words, the ramp-up in this case, and in the case of the strategic defense system, does make a lot of sense.

Dr. **Herzfeld**. Could I add to that, please, Mr. Chairman, and in a way also address a question Senator Bingaman put to me and we did not really get to answer, because I think he had to leave.

As tight as the coming budgets are, the fact that the SDI looms as large in the budget as it does is an indication of the priority of the program as seen by the Secretary and his immediate staff. Clearly, we will try to find as many economies of effort by combining efforts and curtailing things that are not essential, both within SDI and outside, to make that all fit into the total packages, and there are opportunities for this.

We are in the process of going through that now. I cannot possibly describe to you where we will come out because we are just starting, but the answer is we are going to work the problem very hard, and there are things to be worked, so we will try and protect the technologies. The critical technologies will be protected. I think these are doable things.

Senator **Exon**. I do not doubt for a minute your sincerity. I am just sitting up here on the realistic side of the table, and I do not know how we are going to ramp up $70 billion in the next 10 years when we are ramping down everything else. You know, the train wreck is about ready to hit us here, and that is why I am trying to bring this side of the argument out, that it is going to be in the mark-up and it is going to be in the subcommittee. There are mountains to climb and deficit holes to fill that I see as almost insurmountable, and who knows what the summit is going to do to all of these things.

There is just one other thing that I would like to add, and that is this. I believe the testimony is very clear today that if the POM that is being advanced and if the money that is requested would be eventually provided by the Congress, which I think it will not be, but if it were then it is pretty clear to me that about 4 years from now we would, if this works out as you think it would, we would be in a position to suggest breaking out of the treaty—ABM Treaty.

I guess that is somewhat startling to me also, at a time when we are trying desperately to come to negotiation with the Soviets on a whole series of areas reducing armaments. I just wonder what that would do to all of this if we were out predicting today that in 1994 we are going to tell the Soviet Union we are going to bust out of the ABM Treaty. Those are things we have to wrestle with up here, that I think many Members of the Congress are wrestling with regardless of the success of the program.

My time is up. Senator Bingaman.

Senator BINGAMAN. Thank you, Mr. Chairman.

Let me just ask again on the informed decision, I was suggesting to you that the President's informed decision about whether to go ahead with full-scale development of the Phase I system would be made in the summer of 1993. Senator Glenn said 1992. I thought you were agreeing with Senator Glenn and me, both. Which is it?

General MONAHAN. The President has said that it is 1993. Any time between now and about 1993. He said up to 4 years, so that would put it in the summer of 1993. It could be before that, certainly.

Senator BINGAMAN. It could be next year?

General MONAHAN. Yes, Senator. It could be before then. The nature of the decision is not necessarily one that says deploy Phase I. It might be a decision that says let us not deploy Phase I, let us press on with something else, or whatever. I just really do not know.

Senator BINGAMAN. But he will have to decide yes, deploy Phase I or no, do not deploy Phase I. I mean, that is the nature of the decision that he is wanting to make.

General MONAHAN. Phase I and the elements that are in the Phase I architecture can be used to constitute options which the President may address. He may pick part of the Phase I architecture, or none of it, or whatever, so there are a lot of options open to him. So I do not think we should look at it as a decision coming up for deployment of Phase I. That is the wrong way to characterize it.

Senator BINGAMAN. I thought this informed decision was exactly that.

General MONAHAN. I would not limit it to Phase I. I think it is a decision about what parts of the program might we deploy at what time?

Senator BINGAMAN. Here is your testimony. As I understand it, to support the decision—this is the informed decision of the President—the program is structured to continue research and development on a broad range of maturing and advancing technologies. You are saying the informed decision is just sort of a decision about what way to go?

General MONAHAN. I think it is more than that. He said it is a deployment decision on whether or not to deploy such a system, but he will have a lot of options.

Senator BINGAMAN. It is a decision on deployment. You do think it is a decision to deploy or not deploy?

General MONAHAN. Yes, indeed.

Senator BINGAMAN. When this decision is made by the President, would he be advised that going with Phase I as presently structured constitutes a break-out of the ABM Treaty?

General MONAHAN. First of all, I do not believe, nor do I advocate, that we would "break out of the ABM Treaty." The ABM Treaty allows for revision to the ABM Treaty.

Senator BINGAMAN. It would require revision, then?

General MONAHAN. It would require some revision in the defense in space talks at this time. Our American negotiators are working that with the Soviets.

Senator **Bingaman**. So it is your view that going forward with Phase I, if a decision were made to go forward with Phase I, it would not be an action which is presently permitted by the ABM Treaty?

General **Monahan**. Once deployed, it clearly would not be. There is no question.

Mr. **Hadley**. Senator, if I might add a comment on that: one of the things we have been trying to do, in answer to the chairman's point as well, in the defense in space talks, we have tabled a draft treaty under the terms of which, as part of our efforts to get the Soviets to engage in a constructive and cooperative transition involving some defenses, so you do not have this issue of busting out of the ABM Treaty, a provision by which the sides would agree that if either one of them contemplated deployment they would inform the other, they would present a plan as to how that deployment could be part of a movement toward cooperative transition to stable deployment of defenses and offenses, and would negotiate for that at a 3-year period to try to get agreement on a transition phase.

It would be free at the end of that time to exercise its rights under the ABM Treaty, which includes withdrawal, but the whole point of our negotiation on the defense in space talks is to get the Soviets to join with us in an approach to stability that would involve some role for defenses.

Senator **Bingaman**. Let me ask this: as I understand it, you are suggesting that there will be orbital testing in late 1991 perhaps, fairly soon. In our view, does that violate the ABM Treaty?

General **Monahan**. Senator, we will not conduct any tests that violate the treaty, and our policy is to not conduct tests that would even violate what is known as a restrictive interpretation of the treaty, so we clearly will not do that. If we need to go to a broader interpretation of the treaty, as Mr. Herzfeld said, we will come back over here to the Congress and discuss that with you and consult with you.

Senator **Bingaman**. Is it not reasonable for the Congress to say look, we want to know what your interpretation of the treaty is now, when you ask for the $2.3 billion this next year? You know, if you decide to change your interpretation later you will advise us—I mean, is it not reasonable for us to sort of get a definitive statement from the administration as to what interpretation they put on the ABM Treaty before we go forward with this budget?

Mr. **Hadley**. Senator, I am not sure I fully understand your question for this reason. We have taken the position that the broad interpretation is fully justified, but we are proceeding consistent with the narrow interpretation.

Senator **Bingaman**. So you want us to act as though the narrow interpretation applies?

Mr. **Hadley**. Because we have said to you that that is the basis under which we are structuring the program.

Senator **Bingaman**. Congress should review your request for funds for Phase I on the basis of the narrow interpretation?

Mr. **Hadley**. Indeed, we have gone one better, and we have said if there is a piece of that that calls for us to move beyond it, we will notify you and we will consult with you in the normal budgetary process, so our hope is that that offers the kind of assurance you are looking for.

Senator **Bingaman**. Okay. Let me ask about a concern that I brought up with Dr. Herzfeld at an earlier hearing, and that is that the funding that the Department of Defense supplies for a lot of our technology base, our basic technology, is contained in the SDI budget, and as I see the shift in priorities year after year and the continued greater emphasis on Phase I, which is apparent, and I also see the trend of Congress cutting back on your SDI funds because of that emphasis, quite frankly I think that is the main reason that this continues to be a lightening rod here in Congress, is because you are pursuing Phase I with more vigor than ever, and the Congress has great reservations about Phase I.

I am very concerned about what happens to the portion of your SDI budget which is intended to support this tech base, and particularly with regard to the technologies that have been identified as critical by the Department of Defense itself. I would be anxious to know what your thought is about us taking that funding out of SDI's budget, or in some other way getting it so that it is not vulnerable by virtue of the politicization of this agency's budget which has occurred over the last 7 or 8 years?

General **Monahan**. First of all, Senator, I think if you look back over the years you will find, in the technology arena as we define it, that we are higher in absolute level today than we have been in the past, and I would hope that we are able to maintain that. Indeed, we plan to.

It is true that of the 22 critical technologies we pursue within the Department of Defense, about 35 percent of the funding there comes from SDI. I submit that that is a very good way to go about it. The technology examples that I showed you here today I think are a good illustration of that. Anytime this country focuses a lot of technical effort on a certain problem and gets a lot of energy going in one direction, we seem to make an awful lot of progress very, very rapidly. So, I think, by virtue of bringing in a lot of disparate technologies into SDI and having them managed that way, and focused on one problem, we have made progress that is much more rapid than anticipated.

Senator **Bingaman**. My time is up, Mr. Chairman.

Senator **Exon**. Senator Bingaman, thank you very much. There will be some additional questions for the record. Do you have any further questions you would like to ask?

Senator **Bingaman**. I may submit one or two for the record, Mr. Chairman.

Senator **Exon**. Gentlemen, thank you very much. I just want to compliment you for your excellent testimony today. You have been very helpful and forthcoming. We appreciate your testimony, and please respond to the written questions as quickly as you can. Thanks for being here, and once again, Godspeed in your efforts, General, and thanks for your all of your help.

We are adjourned.

[Questions for the record with answers supplied follow:]

QUESTIONS SUBMITTED BY SENATOR SAM NUNN

SDI

Senator NUNN. In response to a question during his March 22, 1990 appearance at the National Press Club, Secretary Cheney said: I can't say that we are capable in the near term of producing a 100 percent effective shield against nuclear weapons. If we deploy even a partial defense force to satisfy, for example, the Phase I deployment designed by the Chiefs that would allow us to intercept approximately 40 percent of a first wave attack and 50 percent of all the SS–18s, that capability in and of itself adds enormously to deterrence. Does this public statement by the Secretary mean that the JCS requirement for Phase I is no longer considered classified by the Defense Department?

Mr. HADLEY. No, the details of the JCS requirement remain classified. The Secretary cited these figures in an effort to demonstrate that less than perfect defenses can contribute significantly to deterrence of a strategic ballistic missile attack.

SUMMIT JOINT STATEMENT

Senator NUNN. On page 9 of your opening statement you say: "there have already been some signs of a more positive Soviet attitude toward strategic defenses." You seem to put great stock in the phrase in the June 1 U.S./Soviet Joint Statement on follow-on START negotiations in which the two sides agree to seek agreements that will "implement an appropriate relationship between strategic offenses and defenses." How is that language different from the January 8, 1985 Shultz/Gromyko "Joint Statement," which provided the mandate for the Nuclear and Space Talks in Geneva and in which the two sides agreed "that the subject of the negotiations will be a complex of questions concerning space and nuclear arms, both strategic and intermediate-range, with all the questions considered and resolved in their interrelationship"?

Mr. HADLEY. The understanding reached in the 1985 Joint Statement established the subject of negotiations and a framework to discuss the U.S. goal of seeking a more stable and secure basis for deterrence through a cooperative transition to a balanced strategic posture including strategic defenses. The June 1, 1990 U.S.-Soviet Joint Statement reflects the progress of these talks. It calls for the sides to "implement an appropriate relationship between strategic offenses and defenses." The Statement obligates the two sides, without delay, to proceed from discussion of the interrelationship between strategic offensive and defensive forces to implementation of an appropriate relationship. It thus recognizes the importance of moving beyond a strategic relationship characterized by an almost exclusive reliance on strategic offensive forces for deterrence. The Statement more clearly defines the remaining course of action and logical objective or "endpoint" of our Defense and Space (D&S) Negotiations.

We view Soviet agreement to this language as a positive step toward our position and away from their agenda of preserving the status quo. Movement in the Soviet official position is paralleled by the emergence of public statements exhibiting a more positive Soviet attitude toward strategic defenses. There has emerged within the Soviet Union a debate concerning the desirability and utility of strategic missile defenses more consistent with our position on implementing a new offense/defense relationship. Soviet analysts, including uniformed military, have written positively about moving with the United States in a cooperative manner to mutual defensive deployments. They have admitted that strategic defenses would be more compatible with the stated Soviet interest in a "defensive doctrine." These authors have also pointed out that ballistic missile proliferation threatens the Soviet Union more directly than it threatens the United States and that strategic defenses may offer a solution to this threat.

It is the combination of official Soviet statements and public discussion of strategic defense which point to a more positive Soviet attitude toward strategic defenses. If we hope to see continued Soviet movement toward our agenda in the Defense and Space Talks, it is essential that the Congress provide adequate funding for the SDI program to permit us to achieve the objectives for the program established by President Bush.

SDI IN REVIEW OF S. 2171, DOD FISCAL YEAR 1991 AUTHORIZATION ACT

Senator NUNN. Does the Defense Department consider the Brilliant Pebbles lifejacket to be the "launcher" for this ABM interceptor missile? If not, what is the "launcher" for Brilliant Pebbles ABM interceptor missiles?

Dr. Herzfeld. The Brilliant Pebbles orbital flight tests 9 through 12 will not involve ABM components, prototypes of ABM components, or devices capable of substituting for ABM components. Specifically, no device covered by the definition of ABM launcher will be used as a lifejacket for these tests.

[Whereupon, at 4:36 p.m., the committee adjourned.]

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